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PATENT ABSTRACTS OF JAPAN

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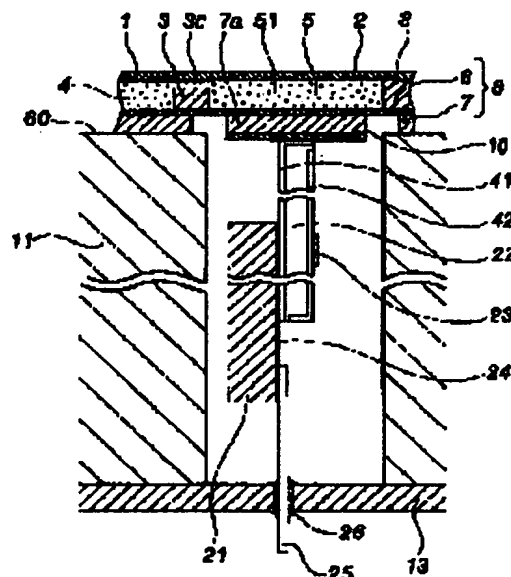
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(54) INK JET PRINTING HEAD AND MANUFACTURE THEREOF

(57)Abstract:

PURPOSE: To stabilize the high-speed-response jetting characteristics, by providing an intermediate member in the part where an elastic member contacts with a piezoelectric element, the width of the intermediate member in the direction in which a plurality of piezoelectric elements are arranged in parallel being smaller than the widths of the elastic member and the piezoelectric element, and by fixing it with an adhesive.

CONSTITUTION: A piezoelectric element 22 in which electric fields are applied to both electrodes 41 and 42 contracts lengthways, however, the lower half of the piezoelectric element 22 is fixed to an anchor block 21 holding by means of a head frame 11 and cannot contract and move from the place, while the upper half contracts and moves from its place and pulls an elastic member 8 via an intermediate member 10. The thin metal plate 6 of the pulled elastic member 8 warps downward, the volume of an ink chamber 5 expands to cause ink 51 to flow in from a reservoir 4 via an ink supply mouth 3c. Subsequently, when the piezoelectric element 22 is released from the electric fields, the ink chamber 5 is compressed, so that droplets of ink are jetted from the nozzle 2. The intermediate member 10 is an insulated member, its width in the direction in which a plurality of piezoelectric elements 10 are arranged in parallel is smaller than the widths of the elastic member 8 and the piezoelectric element 10. A fluid substance for forming the intermediate member 10 is applied to the elastic member 8 and cured.



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CLAIMS

[Claim(s)]

[Claim 1] The elastic member which forms a part of ink room, and the piezoelectric device which it corresponds to an one to one and is arranged in this take joint structure. In the ink-jet formula print head which the aforementioned elastic member is displaced [print head] by the aforementioned piezoelectric device, heightens [print head] the ink pressure of the ink interior of a room, and makes an ink drop breathe out from a nozzle It is the ink-jet formula print head which prepares pars intermedia material in the portion to which the aforementioned piezoelectric device contacts the aforementioned elastic member, and is characterized by the width of face of the aforementioned pars intermedia material in the aforementioned piezoelectric-device two or more parallel direction being narrower than the width of face of the aforementioned elastic member and the aforementioned piezoelectric device, and fixing adhesion.

[Claim 2] The manufacture method of the ink-jet formula print head characterized by applying adhesives in the shape of a thin film, imprinting the thin layer of the aforementioned adhesives in an ink-jet formula print head according to claim 1 to the aforementioned elastic member by which junction fixation is carried out, the aforementioned piezoelectric device, or the formed aforementioned pars intermedia material, pressing the aforementioned elastic member and the aforementioned piezoelectric device, and fixing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention breathes out an ink drop according to a printing signal, and relates to the recording head and its manufacture method of the on-demand type ink jet printer which forms an ink image on record media, such as the recording paper.

[0002]

[Description of the Prior Art] As shown in Japanese patent official report Japanese Patent Publication No. No. 45985 [two to], and JP,2-52625,B, the so-called recording head of the on-demand type ink jet printer which makes an ink drop fly according to a printing signal makes the other end of the piezoelectric device by which the end was fixed to the pedestal contact the elastic wall of the container which forms an ink room through the leg, and is constituted. the member which adjoins the member from which this leg constitutes an elastic wall -- translational motion in alignment with the bearing means of inner cylindrical opening is carried out According to the technology of this official report, a piezoelectric device is shrunk, ink room volume is increased, ink room volume is decreased by expanding a piezoelectric device again, and ink is breathed out as a drop from the nozzle. Furthermore, the composition of this technology has taken the structure of carrying out the line contact of the leg to a bearing means, and making it supporting.

[0003]

[Problem(s) to be Solved by the Invention] The size of a piezoelectric device or an ink room becomes small, so that miniaturization of a recording head and densification are attained. the composition of the above-mentioned official report -- a leg member and leg insertion bearing composition -- it is the structure which carries out the laminating of the member of complicated configurations, such as a member, and it is very difficult to manage the size of the miniaturized each part material with high precision, and to manufacture it That is, it has the trouble that it is difficult to acquire the contact state of the leg and the leg insertion bearing composition member which transmit the generating force from a piezoelectric device for required accuracy in two or more ink regurgitation equipments.

[0004] moreover, the leg mutual [of ink regurgitation equipment] in transfer of the generating force from a piezoelectric device, and multiple -- the same leg insertion bearing composition -- a member -- it has the trouble of interfering in order to carry out translational motion inside

[0005] Furthermore, the rigid lowered piezoelectric device which became small [a size] is made included in the regular position, the load to the aforementioned transection direction to a piezoelectric device is added, and the alignment at the time of arranging in a piezoelectric device and the leg the alignment or the engagement means of a piezoelectric device and the piezoelectric device to the leg structure which prevents the lateroduction of the transection direction to the piezoelectric-device major axis of a piezoelectric device by the coupling means of the leg has the trouble of spoiling the reliability of a piezoelectric device.

[0006] It has the trouble that the rigidity of a bond part is low since mechanical coupling means are moreover used between the leg and the elastic wall, and the high-speed responsibility of the ink regurgitation is not obtained.

[0007] Then, the overall purpose of this invention is to offer the joint structure where it was improved between the piezoelectric transducer and the elastic wall.

[0008] Other purposes of this invention are to offer the cheap joint method.

[0009] Other purposes of this invention are to offer the joint structure and the joint manufacture method of mass-producing easily.

[0010] It is in other purposes of this invention offering the joint method that a uniform performance can be demonstrated with two or more ink regurgitation equipments with little piezoelectric-device generating force loss.

[0011] Other purposes of this invention are to offer the joint structure which prevents a mutual interference of ink regurgitation equipment.

[0012] Other purposes of this invention are to offer the joint method of having reliability.

[0013] Other purposes of this invention are to offer the joint method which the high-speed responsibility of the ink regurgitation has.

[0014]

[Means for Solving the Problem] The elastic member in which the ink-jet formula print head of this invention forms a part of ink room, In the ink-jet formula print head which joint structure is taken with the piezoelectric device which it corresponds to an one to one and is arranged in this, the variation rate of the aforementioned elastic member is carried out [print head] by the aforementioned piezoelectric device, it heightens [print head] the ink pressure of the ink interior of a room, and makes an ink drop breathe out from a nozzle Pars intermedia material is prepared in the portion to which the aforementioned elastic member and the aforementioned piezoelectric device contact at least one side of the aforementioned elastic member and the aforementioned piezoelectric device. And the width of face of the aforementioned pars intermedia material in the aforementioned piezoelectric-device two or more parallel direction is narrower than the width of face of the aforementioned elastic member and the aforementioned piezoelectric device, and each part material is characterized by fixing adhesion. Furthermore, the manufacture method of the ink-jet formula print head characterized by imprinting the thin layer of the adhesives which applied adhesives to the thin film and were applied on the aforementioned thin film in the manufacture method to the aforementioned elastic member by which junction fixation is carried out, the aforementioned piezoelectric device, or the formed aforementioned pars intermedia material, pressing the aforementioned elastic member and the aforementioned piezoelectric device, and fixing.

[0015]

[Example] Drawing 1 is the perspective diagram showing the composition of one example of this invention, and disassembles each part article after assembly. Drawing 2 , drawing 3 , drawing 4 , and drawing 5 show the fragmentary sectional view which drew this example on the detail more, the fragmentary sectional view which rotated the aforementioned fragmentary sectional view of this example 90 degrees, the partial perspective diagram which looked at this example from the lower part, and the part plan which looked at this example from right above, respectively. In addition, drawing 5 shows the state where the component part was penetrated one by one from the top. The fragmentary sectional view drawing 6 explains the conventional trouble to be, and drawing 7 show the fragmentary sectional view explaining the effect in the structure of this invention. Drawing 8 and drawing 9 show the fragmentary sectional view for explaining one example of the manufacture method of an ink room. Drawing 10 shows the fragmentary sectional view for explaining the manufacture method which forms pars intermedia material based on the composition of the example of this invention. Drawing 11 shows the fragmentary sectional view for explaining the manufacture method of this invention based on the example of this invention. Drawing 12 and drawing 13 show the fragmentary sectional view for explaining other examples of this invention.

[0016] In these drawings, 1 is a nozzle substrate. Two or more nozzles 2 are formed in the nozzle substrate 1. 3 is a cavity formation substrate. The cavity formation substrate 3 is pinched by the elastic member 8 used as the nozzle substrate 1 and an elastic wall, and forms a reservoir 4 and the ink room 5. An elastic member 8 accomplishes the laminated structure which consists of a sheet metal 6 and wall material 7. After adhesion junction is carried out one by one

and an elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 form a cavity, they form in an elastic member 8 side the pars intermedia material 10 mentioned later, and adhesion junction is carried out on the head frame 11.

[0017] this invention is explained based on drawing 1. The piezoelectric device 22 used as the driving source of the ink drop regurgitation fixed the whole surface of the abbreviation half of the longitudinal direction to standing ways 21, and has joined the nose of cam 50 of the half which does not fix to the pars intermedia material 10. The flow circuit pattern 24 of a positive electrode and a negative electrode is given to standing ways 21, and the electric field controlled by the control board 13 are given to a piezoelectric device 22 through a leadframe 25. 11 is a head frame. 12 is the installation hole which penetrates the inside of the head frame 11, and supports standing ways 21 to carry out X of a piezoelectric device 22, and alignment (to refer to the XYZ coordinate of drawing 1) of the direction of Y. In addition, the Z direction of a piezoelectric device 22 carries out alignment of the nose of cam 50 of a piezoelectric device 22 in contact with the pars intermedia material 10 after joining the zygote which joined the pars intermedia material 10, the elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 to the head frame 11.

[0018] 31 is an ink supply pipe which supplies ink 51 from an ink reservoir (not shown). Pressing junction of the ink supply pipe 31 is carried out at the head frame 11. Ink passage is open for free passage through the ink end connection 32 in the head frame 11, and the ink connection mouth 33 in an elastic member 8 with the reservoir 4 of the cavity formation substrate 3, and also the ink room 5. The above is outline composition.

[0019] According to drawing 2 and drawing 3, structure is described in more detail. Drawing 2 is a fragmentary sectional view when disconnecting one piezoelectric device of the piezoelectric device 22 which carries out two or more parallel (the direction of X of drawing 1) from a center in the direction of Y of drawing 1. Wall material 7a which the piezoelectric device 22 of an elastic member 8 contacts through the pars intermedia material 10 is aiming at rigid reinforcement to the sheet metal 6 in order to obtain uniformly as much as possible the amount of displacement of the elastic wall of the ink room 5 at a large area, since the ink room cross section is larger than the contact section cross section of a piezoelectric device 22. One electrode 42 of one electrode 41 and others has countered. [piezoelectric device / 22] Electrical connection of the electrode 41 is carried out to the circuit pattern 24 on standing ways 21 simultaneously with junction. Electrical connection of other electrodes 42 is carried out to the circuit pattern 24 on standing ways 21, and the electrode contrary to especially the electrode 41 with the common board 23. The circuit pattern 24 and the control board 13 were connected with the leadframe 25, and the connection place is fixed with solder 26, respectively. In addition, standing ways 21 are in the state to which the piezoelectric device 22 contacted the pars intermedia material 10, and junction fixation is carried out at the head frame 11. That is, alignment of the Z direction of a piezoelectric device 22 is carried out by the pars intermedia material 10. The flat surface 60 of the head frame 11 which contacts the wall material 7 is finished with high precision by meanses, such as flat-surface polish.

[0020] Drawing 3 is a fragmentary sectional view when cutting from a center in the direction of X of drawing 1 of the piezoelectric device 22 arranged in parallel. [two or more] The nozzle substrate 1, the cavity formation substrate 3, and an elastic member 8 are the laminated structures which carried out adhesion junction, in order to carry out adhesion junction, the wall material 7 of an elastic member 8 needs to apply a junction pressure to wall 3e which contacts the nozzle substrate 1 and an elastic member 8 and which separates between an ink room, and wall material 7a which transmits the generating force from a piezoelectric device 22 arranges wall material 7b independently.

[0021] On the other hand, the ink room 5 and reservoir 4 with which it fills up with ink 51 are formed lik drawing 5 by the cavity formation substrate 3, the nozzle substrate 1, and the elastic member 8. Although the cavity formation substrate 3 can be made with etching processing of glass, the laminating of a sheet metal, exposure formation of a photopolymer, injection molding of a resin, etc., the photopolymer cheap in cost is used for it by this example. The wrap nozzle substrate 1 consists the upper surface of the cavity formation substrate 3 of a stainless steel

plate with which every one nozzle 2 was opened in two or more ink rooms 5, respectively and which is about 0.1mm by press working of sheet metal. The nozzle substrate 1 can be made also by the nickel-electroforming processing method. Moreover, the structure which carried out the laminating of the wall material 7 formed in the thickness of about 10-100 micrometers by the said processing method to the sheet metal 6 by which the wrap elastic member 8 formed the inferior surface of tongue of the cavity formation substrate 3 in the thickness of 5 micrometers or less by the nickel-electroforming processing method is made. The wall material 7 can acquire a required configuration easily by applying a resist. Although a sheet metal 6 is so desirable that it is thin in order to tell expansion and contraction of a piezoelectric device 22 efficiently to the ink room 5, the ink 51 in the ink room 5 must not ooze out. It is because ink 51 adheres between one electrode 41 of a piezoelectric device 22, and one of other electrodes 42, and to a control board 13 and it short-circuits electrically, when ink 51 presents conductivity. Moreover, resins, such as a film, can also be substituted for a sheet metal 6. Although it will become simple as composition if a piezoelectric device 22 is directly joined to a sheet metal 6, this is not made for the following reasons. The piezoelectric device which adjoins if an electrode 41 contacts a sheet metal 6 as one reason as shown in drawing 2 will connect too hastily. Temporarily, ink 51 will be joined by electric field when an electrode 41 side is used as a common electrode. This leads to ink 51 ionizing with time and causing degradation of reliability. Then, by allotting insulating member, i.e., a photopolymer, to the pars intermedia material 10, it will be released from the above-mentioned problem and the flexibility of the wiring for controlling a piezoelectric device 22 will increase. Another reason has the cross-section configuration of a piezoelectric device 22, and the cross-section configuration of the ink room 5 in differing from a cost side and the reasons of manufacture, as shown in drawing 5. In case a piezoelectric device 22 carries out the pressurization and decompression of the ink room 5, as this is shown in drawing 5, the length (b) of an elastic member 8 which can be displaced is too short, and it cannot fully bend, but it will elapse and the length (b) of an elastic member 8 which can be displaced conversely will absorb the pressure [being long] to generate. Therefore, in order to carry out the pressure transfer of the variation rate of a piezoelectric device 22 efficiently at the ink room 5, the middle transfer member which can secure a length (b) (b) appropriately is needed. Wall material 7a which has rigidity from the reason for the above is needed. Therefore, wall material 7a is designed somewhat smaller than the plane of projection of the ink room 5 so that it may bend as shown in drawing 5, and an amount can be secured. The form which shows wall material 7a in drawing 4 by the electroforming method is made. Moreover, as shown in drawing 7, the pars intermedia material 10 is formed for margin increase of the alignment of the nose of cam 50 of a piezoelectric device 22, and wall material 7a, and, as for the end face of wall material 7a which is an insular part, the nose of cam 50 of a piezoelectric device 22 is joined to this.

[0022] Here, ink drop discharging is explained using drawing 2. According to a printing signal, electric field are impressed to one electrode 41 of a piezoelectric device 22, and one of other electrodes 42 through a leadframe 25 and a circuit pattern 24 from a control board 13. It is going to contract the piezoelectric device 22 to which electric field were impressed to a longitudinal direction (this drawing vertical direction). At this time, the lower half of a piezoelectric device 22 has fixed to the standing ways 21 held at the head frame 11, and cannot carry out contraction displacement. On the other hand, the upper half of a piezoelectric device 22 carries out contraction displacement, without receiving other restraints, and pulls an elastic member 8 through the pars intermedia material 10 with the shrinkage force. The sheet metal 6 of the elastic member 8 pulled by the piezoelectric device 22 through the pars intermedia material 10 bends below, and, as a result, the volume of the ink room 5 expands. If the ink room 5 expands, ink 51 will flow through ink feed-hopper 3c from a reservoir 4. Subsequently, if the electric field of a piezoelectric device 22 are canceled, it will elongate to the original length and a piezoelectric device 22 will compr ss the ink room 5. The regurgitation of the ink drop is carried out from a nozzle 2 by this pressure. Wall material 7a of the pars intermedia material 10 and an elastic member 8 which tells the variation rate of a piezoelectric device 22 to the ink room 5 pressurizes and decompresses the ink room 5 uniformly, leaving the deflection section of a sheet metal 6, since it is somewhat smaller than the plane of projection of the ink room 5, as

mentioned above.

[0023] By the way, in the conventional example of joint structure which does not form the pars intermedia material 10 of this invention, two or more ink rooms 5 are close, and the leg 27 is arranged in an one to one. Piezoelectric-device 22a and the leg 27 are joined directly [after / contact], in order to abolish loss at the time of generating force transfer. However, by the alignment of the structure where a size is extremely small, as shown in drawing 6, an edge starts the leg 27 which piezoelectric-device 22a adjoins, and they are the contiguity ink rooms 5, 5, and 5.... There is a possibility of interfering in between. moreover, elastic member 8a which is the oscillating section in adhesives being applied so much partially -- bearing composition -- the danger of being solidified with a member 28 is also high. Therefore, in order to join piezoelectric-device 22a and elastic member 8a, it is necessary for this gap to apply necessary minimum adhesives. After applying generally as the adhesion method so that it may not come out of the adhesives of a constant rate with a coating thickness rose to each application section at piezoelectric-device 22a or elastic member 8a, both are held in the state where it contacted and these adhesives are stiffened. Possibility that restrictions on a process will be greatly realized on structure except [this], for example although it is possible to be filled up with the moderate amount [a / elastic member 8 / piezoelectric-device 22a and] according to each gap of piezoelectric-device 22a and elastic member 8a after contact is very small. Then, the method of applying, while managing the adhesives of a constant rate will be taken.

[0024] When the alignment of piezoelectric-device 22a and elastic member 8a is difficult with the structure where a size is extremely small, in the junction state of adhesives, a large state with a rose will be formed like 9a, 9b and 9c of drawing 6, and Here, although three typical types are illustrated, actual much more junction states have arisen. 9a showed the junction state which is not a problem, was stabilized as junction in the dynamic pressure transfer to elastic member 8a from piezoelectric-device 22a, and has hardened it to it. It is because the adhesives on this, i.e., elastic member, 8a or piezoelectric-device 22a are maintained at optimum dose. On the other hand, 9b shows the state where it joined to the leg 27 which the leg 27 which should be joined adjoins. In this state, the regurgitation of the ink from the unnecessary ink room 5 besides the purpose will arise. that 9c is the excess of an adhesives coverage, and nozzle substrate 1a, 3d of cavity formation substrates, elastic member 8a and bearing composition -- the rose and curvature of the thickness direction which are produced by the manufacture process of a member 28 -- the gap of the leg 27 and piezoelectric-device 22a -- narrow -- a bird clapper -- originating -- bearing composition -- the state where the member 28 is also joined is shown this state -- again -- the leg 27 and bearing composition -- piezoelectric-device 22 from relation in which member 28 must operate smoothly a -- a variation rate -- in a direction, the two aforementioned member cannot form big ****, therefore it will be easy to incorporate the adhesives B on piezoelectric-device 22a in a wall material 7a row easily like 9c, and expansion and contraction of piezoelectric-device 22a will be prevented therefore -- in order to prevent defluxion of Adhesives B, while changing into a suitable and uniform state the gap of the half nose of cam 50 and the contact side of the leg 27 which piezoelectric-device 22a does not fix -- the leg 27 and bearing composition -- it is important to distinguish between the application height ha grade of adhesives at least with a member 28

[0025] On the other hand, drawing 7 is a fragmentary sectional view explaining the effect by having formed the pars intermedia material 10 carried out by this invention. moreover, the leg 27 and bearing composition -- ***** structure is shown for the cure to friction between members 28. In this drawing, the pars intermedia material 10 is formed by the method of mentioning later, and the state where it was joined to piezoelectric-device 22a is shown. As shown in this drawing, pars intermedia material amends the rose and camber of the thickness direction by the manufacture process of 10d, 10e, nozzle substrate which is 10f and was mentioned above 1a, 3d of cavity formation substrates, and elastic member 8b, and as 9d, 9e, and 9f show, it forms the moderate gap. Moreover, the level difference of the height of the pars intermedia material 10 and contiguity wall material 8b is harnessed by the manufacture method mentioned later, it is stabilized and the adhesion state is formed. Drawing the adhesives B on wall material 8b which adjoins when Adhesives B are moreover applied to up to wall material 8b in piezoelectric-device

22a is lost.

[0026] In addition, besides the above-mentioned example, the pars intermedia material 14 can also be formed in a piezoelectric-device 22 side like drawing 12 . Moreover, like drawing 13 , the pars intermedia material 16 can be formed in a piezoelectric-device 22 side, and the pars intermedia material 15 can also be formed in an elastic member 8 side.

[0027] Next, according to drawing 8 and drawing 9 , the manufacture method of the zygote of an elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 is described.

Drawing 8 and drawing 9 show the cross section seen from [of a piezoelectric device 22] two or more parallel. Although there are methods, such as press working of sheet metal, electrocasting fabrication, and etching, as a manufacturing method of the cavity formation substrate 3, it is a process using the easiest photopolymer film here, and the cavity formation substrate 3 is divided and formed in each of the nozzle substrate 1 and an elastic member 8 at the two sections, and how to weld and make behind to the two sections which carried out division formation is explained. First, drawing 8 is used and the cavity formation by the side of the nozzle substrate 1 of the cavity formation substrate 3 is explained. The photopolymer film (it is called a dry film below) 61 is laminated like the above-mentioned in the nozzle substrate 1 processed by press working of sheet metal or the electroforming method. Next, the glass mask 62 in which the pattern which exposes ultraviolet rays, and the pattern which is not exposed were formed is arranged on the dry film 61 side, and it exposes by irradiating ultraviolet rays. After exposure, the portion hardened by exposure and the unexposed portion which is not exposed are formed on the dry film 61. Next, by developing negatives, an unexposed portion is removed and the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1 is completed.

[0028] A zygote 80 is completed by forming cavity formation substrate 3b on the elastic member 8 into which the elastic member 8 side as well as the aforementioned cavity formation substrate 3a was processed by the electroforming method like drawing 9 on the other hand. And when the completion object of a cavity contacts and welds both of the zygote 80 of the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1, cavity formation substrate 3b, and an elastic member 8 at the temperature of 150-170 degrees C, the cavity formation substrate completion object 90 is manufactured. Although a dry film front face is welded by heat at this time, the amount of crushing of a dry film is determined by welding pressure and time. Moreover, it becomes important, when that pressurization accomplishes equally lessens with [of the amount of crushing of a dry film] a rose. Then, wall material 7b is arranged in the position where cavity formation substrate 3a and cavity formation substrate 3b contact for the purpose of ***** etc., and stabilization with the rose of the amount of crushing of a dry film is attained. Therefore, adjoining ink rooms 5, 5, and 5 Wall material 7b is arranged in between, an interval with wall material 7a becomes dense, and a high-density array becomes difficult. Therefore, it becomes important to form the pars intermedia material 10 at the time of junction to a piezoelectric device 22. Moreover, the imbalance of the amount of crushing tends to happen in fact depending on how to allot the existence of the weld meat on a dry film, i.e., a pattern. Moreover, in the cooling process from heating at the time of weld to ordinary temperature, it becomes easy to generate a camber. From the above reason, it is easy to generate with [of thickness h of the cavity formation substrate completion object 90] a rose at the time of manufacture. Therefore, also in with [of a piezoelectric device 22 and an elastic member 8] a gap rose, the pars intermedia material 10 will play an important role.

[0029] Drawing 10 shows the process which forms the aforementioned pars intermedia material 10. 90 is a cavity formation substrate completion object. First, fluid matter 10a which forms the pars intermedia material 10 in the elastic member 8 side of the cavity formation substrate completion object 90 is applied. Priming may be performed to an elastic member 8 for the purpose of the improvement in the adhesion force before an application if needed. Although a photopolymer, thermosetting resin, and a room-temperature-setting nature resin are raised, as for fluid matter 10a, polyester resin, acrylic resin, an epoxy resin, an APR resin, and various resists are used especially. In this example, it can treat comparatively easily and polyester resin (photopolymer) cheap also in cost is used. Next, the PET film aiming at a mold-release

characteristic is laid in the portion which makes a fixed distance estrange from the portion of an elastic member 8 which serves as a convex most and which prepared the gap member (not shown) more than imprint adhesives height h_a (drawing 11) to the below-mentioned pars intermedia material 10 top at last rather than fluid matter 10a at least at the latus range. Next, the glass mask 91 used as flat criteria is laid on the aforementioned film. The pattern is arranged on this glass mask 91 in order to form the exposure section and the unexposed section alternatively to fluid matter 10a. Furthermore, even if there are few these glass masks, the flatness of about 0.1–0.2 micrometers is made to one side by the side of a film by polish processing. After laying this glass mask 91, it exposes by irradiating ultraviolet rays with the wavelength of about 300–400nm. Since it is hard to expose fluid matter 10a to 400nm or more of visible rays, a dark room and a special facility are unnecessary. After the aforementioned exposure, 2 ****s of fluid matter 10a are carried out, the exposed section causes and hardens a chemical change and the unexposed section is maintaining the fluid state. A portion fluid in the unexposed section is removed in this state. Since fluid matter 10a is easily removable with a weak lye or water, work is safe and harmless. Moreover, a postexposure can also be carried out if needed in order to stiffen a part for a hard spot still more certainly. Moreover, the temperature of 60–80 degrees C may be applied for the purpose of dryness of the component swollen at the time of unexposed section removal. By the above method, the pars intermedia material 10 can be formed and the highly precise pars intermedia material 10 of the same grade as the aforementioned glass mask 91 can be formed about flat-surface precision. In addition, the highly precise pars intermedia material 10 can be similarly formed about the aforementioned thermosetting resin or a room-temperature-setting nature resin also except this example.

[0030] Next, the manufacture method that an adhesion coverage is stabilized and the pars intermedia material 10 and piezoelectric device 22 which were formed on the cavity formation substrate completion object 90 arranged with high density according to drawing 11 can be obtained easily is explained. The flatness grade of a glass mask is made to the flat-surface precision of the pars intermedia material 10 on wall material 7a of the elastic member 8 formed by the aforementioned manufacture method as aforementioned. However, it is about 1–3 micrometers with [with the aforementioned pars intermedia material 10] a gap rose by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix. It is stored with the gap rose in the minimum until now. Then, you have to absorb with a remains rose in the height h_a of Adhesives B. Therefore, you have to apply the height h_a of Adhesives B uniformly on the pars intermedia material 10 by the grade which is not protruded into a sheet metal 6 from at least 4 micrometers even if many. As the method of an adhesives B constant-rate application, although there are a spin coat, spray printing, octopus printing, a monotonous imprint, and screen-stencil, since the flash to a sheet metal 6 is strict prohibition, with this structure, a spin coat, spray printing, and screen-stencil cannot be used. Moreover, a sheet metal 6 is very as thin as 5 micrometers or less, and in octopus printing, since a pressure is added, it cannot be used, being able to draw destruction of a sheet metal 6. Although one side generally imprints to a transferred object about a monotonous imprint using the plate which has a highly precise flat-surface precision, with this structure, although it is a minute amount about a small amount of adhesives B, it must imprint to the pars intermedia material 10 which has with a flatness rose, and if it takes that the upper pressure cannot be applied into consideration, a monotonous imprint will serve as a method unsuitable for a constant-rate application. Then, to the structure of this invention, the application whose film harnessed the feature which follows with [of flatness] a rose, and managed the imprint height h_a with high precision by the film imprint which is one of the decalcomania methods is performed.

[0031] As shown in drawing 11 , the manufacture method is close in the 5 micrometers – 20 micrometers film of a polyimide by this example to the plate which has made about 0.1–0.2 micrometers to one side, manages the height on the film of Adhesives B in the upper part, and it installs the spacer 65 which restricts an area required for an imprint. Adhesives B are dropped at application within the limits of this spacer, an edge has flat nature in a line, and writes the excessive adhesives B to it, and it eliminates with a board. By performing this process of a

series of quickly, adhesives B height of the same grade as spacer ** is obtained. And after eliminating a spacer, the film with which Adhesives B are applied is put on up to the pars intermedia material 10 using the surface tension of Adhesives B. Since the film with which Adhesives B are applied is flexible, it is followed in the shape of [of the cavity formation substrate completion object 90] surface type, and can be drawn near according to the viscosity of Adhesives B. At this time, the film is gradually put on up to the pars intermedia material 10 and wall material 7b so that a foam may not mix in the adhesives B application section. The portion which Adhesives B contacted will obtain the adhesives B imprinted by the uniform height h_a , if this film is removed. Since a film imprint follows the configuration of a transferred object irrespective of the flatness of a transferred object, the amount of imprints of Adhesives B is uniformly imprinted also in which imprint portion. A front face is rectangular continuation, and since the pars intermedia material 10 serves as a height, as for this transferred object, the little application of the adhesives B is carried out at the side. Therefore, the adhesives meniscus configuration at the time of junction results to the side of the pars intermedia material 10, and can obtain junction high intensity. The feature of a film imprint is doubling the rigidity of a film, and the kind of film in the shape of [of a transferred object] surface type, choosing them, and choosing what was suitable for the surface area of a transferred object, and the surface state in the principal component of adhesives, and viscosity, and the adhesives application of the parts of the complicated shape of various surface type and surface roughness can carry it out to coating thickness homogeneity easily. As mentioned above, like drawing 7, by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix, piezoelectric-device 22a is stabilized in the adhesives B of the uniform height h_a on the easy pars intermedia material 10 obtained by the method of becoming, without [without it joins to wall material 7b, and] adhesives flowing out to a sheet metal 6, and is joinable to wall material 7a at them.

[0032] The joint structure of the piezoelectric device 22 and elastic member 8 which were formed as stated above can be transmitted to the ink room 5 without loss of the generating force of a piezoelectric device 22. As a feature, the joint structure between a piezoelectric device 22 and an elastic member 8 is in each ink regurgitation equipment not to receive the restraint from from [else] at all. Moreover, the pars intermedia material 10 is a resin, a light thing and by having stabilized the upper adhesives coverage and having formed the pars intermedia material 10, a large margin can be taken to alignment and a piezoelectric device 22 and an elastic member 8 can be joined to contact exactly easily.

[0033]

[Effect of the Invention] As explained above, with the joint structure between the piezoelectric device of the ink regurgitation equipment arranged by being close in parallel, and wall material, rigid-body-ization of an and also [it is based on adhesives defluxion] can be prevented, and the high-density array of ink regurgitation equipment is enabled. Moreover, since between each part material is firmly combined by junction, high-speed responsibility is realizable. Furthermore, since pars intermedia material can manage and form **** with a contiguity member, junction to contiguity wall material can be prevented, the large margin of the alignment to the elastic member of a piezoelectric device can be taken in the direction of a flat surface, and since the load according [a piezoelectric device] to combination to the transection direction of the displacement direction is not added, reliability is acquired. Consequently, the variation rate of a piezoelectric device can be told to an ink room now faithfully and efficiently, and the high-density head by which the ink regurgitation property of having high-speed responsibility was stabilized can be obtained.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram showing the composition of one example of this invention.

[Drawing 2] It is the fragmentary sectional view of an example same as the above.

[Drawing 3] It is the fragmentary sectional view of the field which the example same as the above rotated 90 degrees.

[Drawing 4] It is the partial perspective diagram which looked at the example same as the above from the lower part.

[Drawing 5] It is the plan which looked at the example same as the above from right above.

[Drawing 6] It is a fragmentary sectional view explaining the problem of the conventional example.

[Drawing 7] Book

[Drawing 8] It is drawing showing one process of one example of this invention.

[Drawing 9] It is drawing showing one process of an example same as the above.

[Drawing 10] It is drawing showing one process of an example same as the above.

[Drawing 11] It is a fragmentary sectional view explaining the manufacture method of this invention.

[Drawing 12] It is the fragmentary sectional view of other examples of this invention.

[Drawing 13] It is the fragmentary sectional view of other examples of this invention.

[Description of Notations]

1 1a Nozzle substrate

3 3d Cavity formation substrate

5 Ink Room

6 Sheet Metal

7, 7a, 7b wall material

8 8a Elastic member

9a, 9b, 9c, 9d, 9e, 9f Flow hardening state of adhesives

10, 10d, 10e, 10f, 14, 15, 16 Pars intermedia material

10a Fluid matter

11 Head Frame

12 Installation Hole

21 Standing Ways

22 22a Piezoelectric device

23 Common Board

24 Circuit Pattern

25 Leadframe

27 Leg

28 Bearing Composition -- Member

31 Ink Supply Pipe

32 Ink End Connection

33 Ink Connection Mouth

51 Ink
60 Head Frame Flat Surface
61 Photopolymer Film (Dry Film)
62 Glass Mask
90 Cavity Formation Substrate Completion Object
91 Glass Mask (Basis Jumpei Board)

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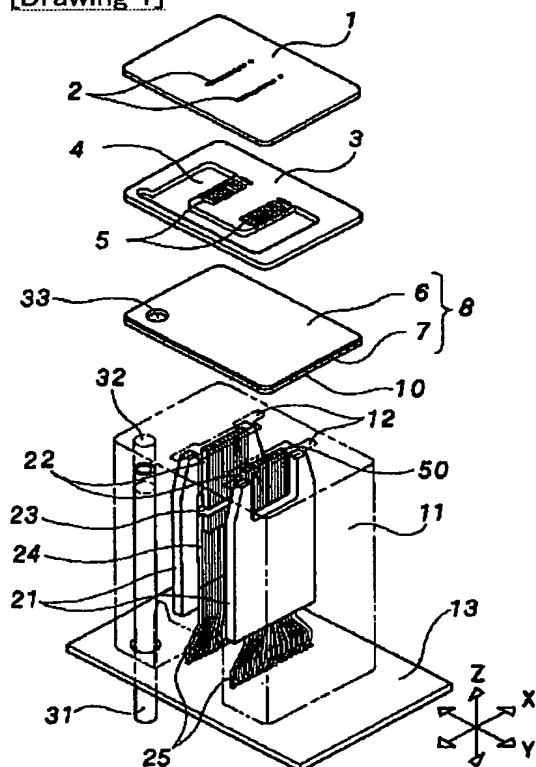
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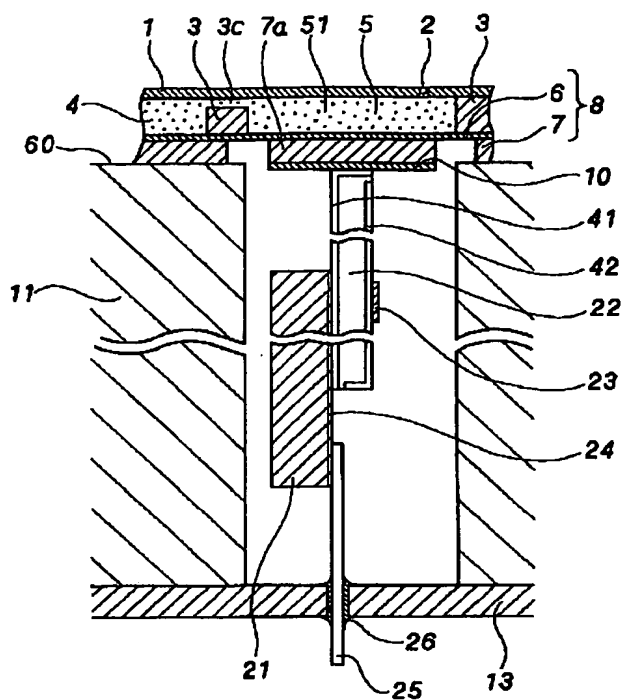
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DRAWINGS

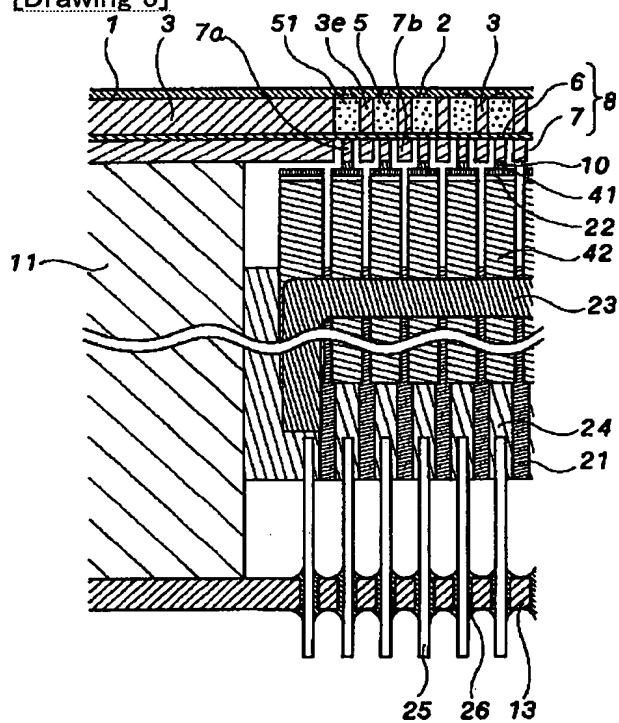
[Drawing 1]



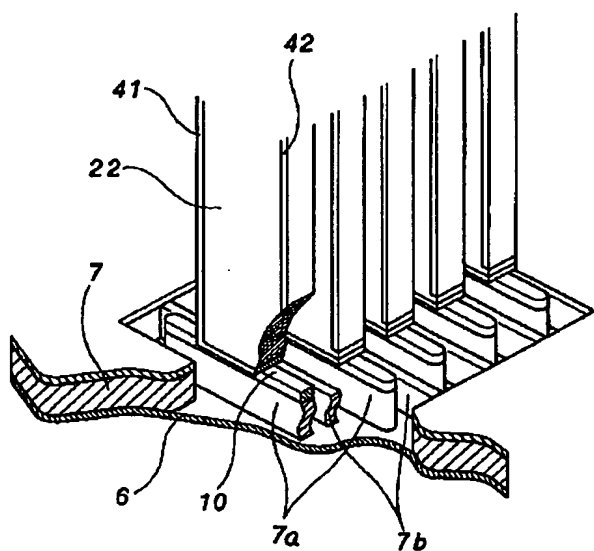
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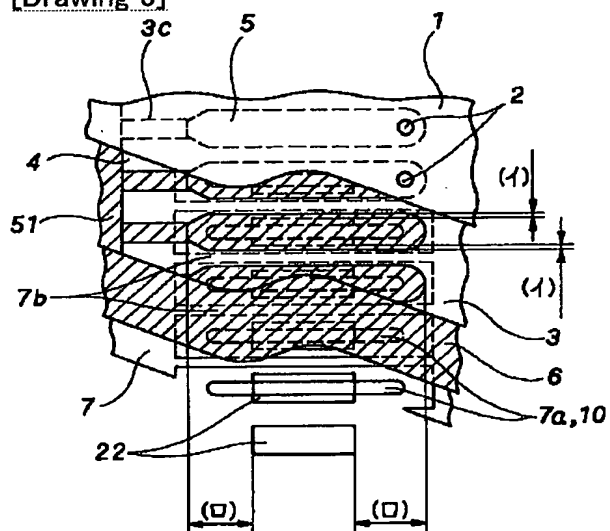
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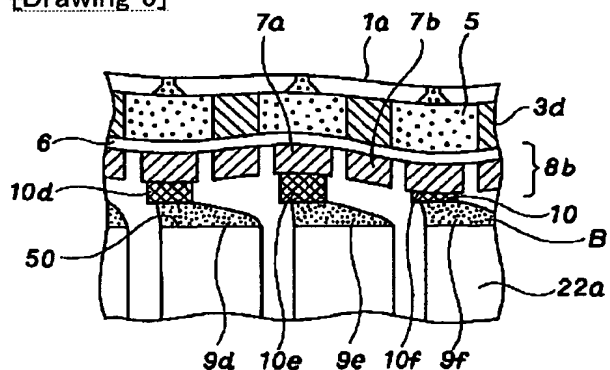
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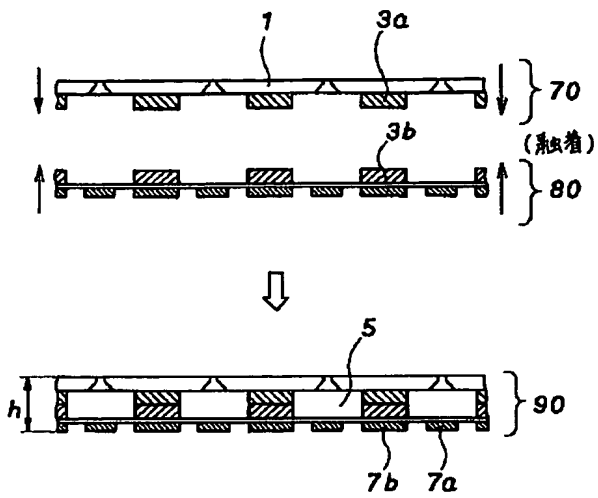
[Drawing 5]



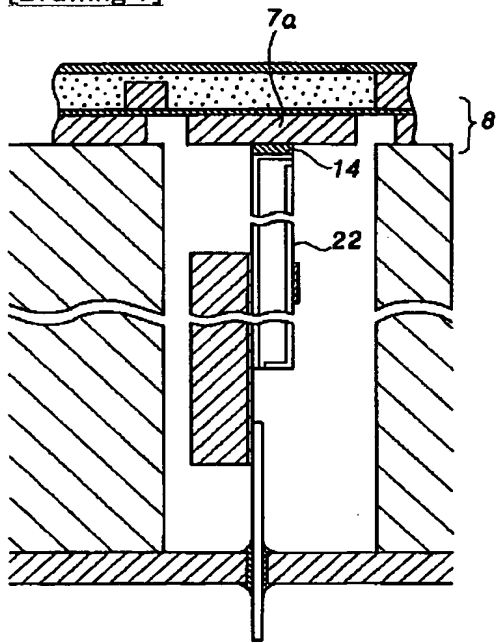
[Drawing 6]



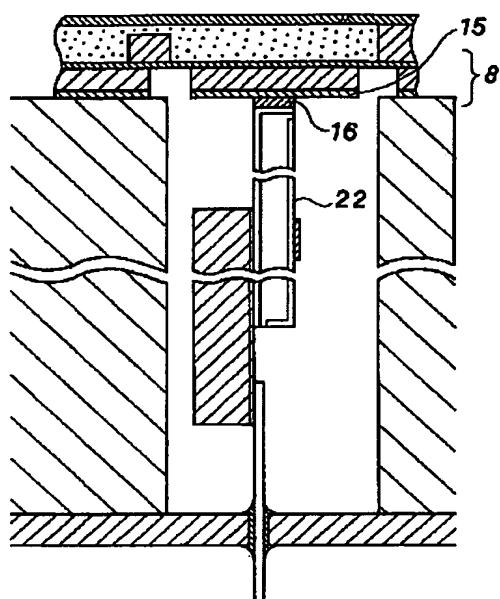
[Drawing 10]



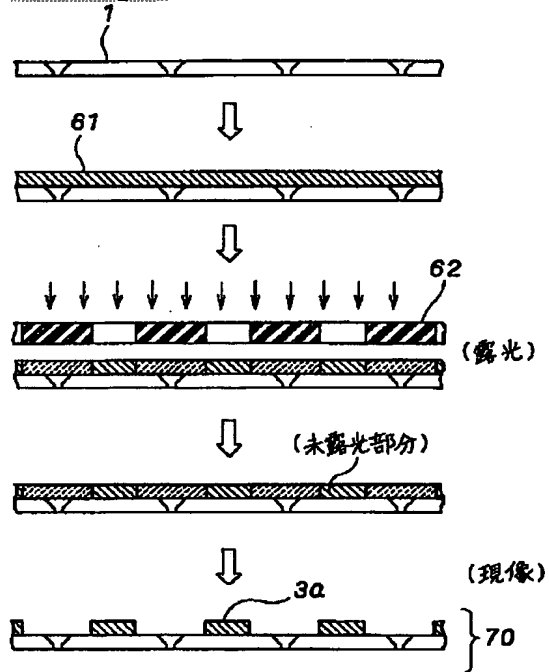
[Drawing 7]



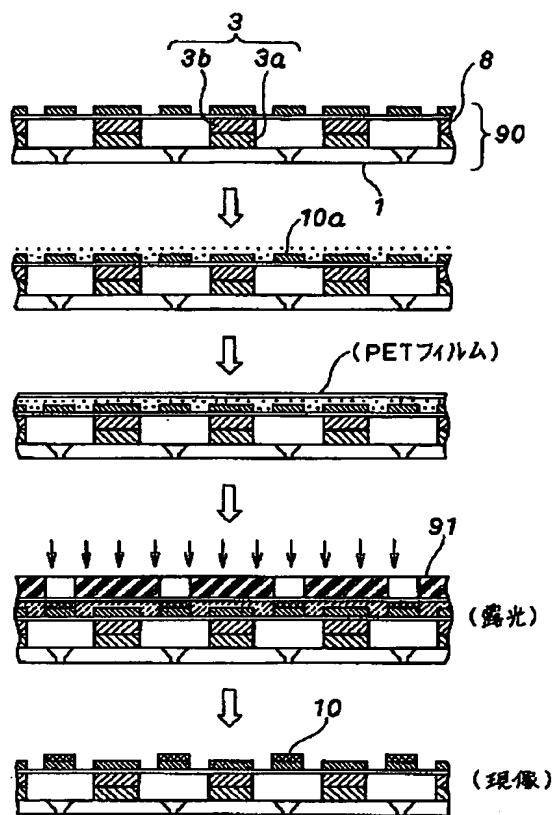
[Drawing 8]



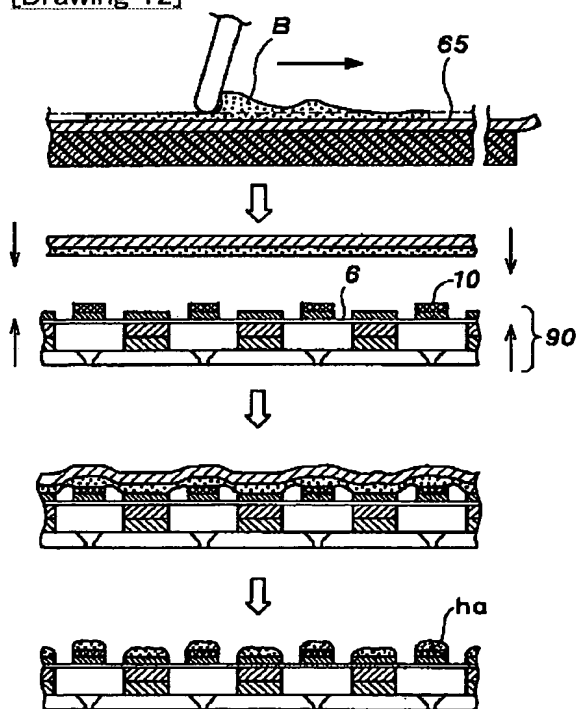
[Drawing 9]



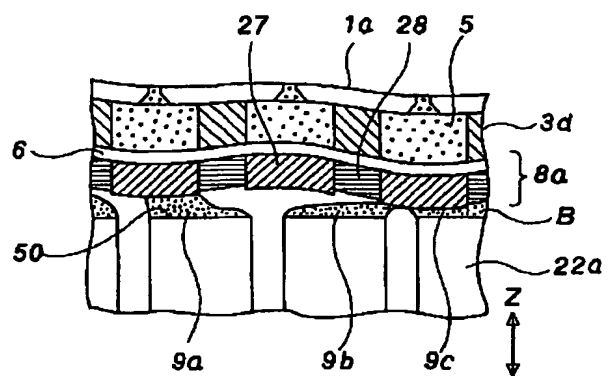
[Drawing 11]



[Drawing 12]



[Drawing 13]



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CORRECTION or AMENDMENT

[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law
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B41J 3/04 103 A
 103 H

[Procedure revision]
 [Filing Date] June 1, Heisei 11 (1999. 6.1)
 [Procedure amendment 1]
 [Document to be Amended] Specification
 [Item(s) to be Amended] Whole sentence
 [Method of Amendment] Change
 [Proposed Amendment]
 [Document Name] Specification
 [Title of the Invention] An ink-jet formula print head and its manufacture method
 [Claim(s)]

[Claim 1] In the ink-jet formula print head which it has a nozzle, this nozzle, an ink room open for free passage, the elastic member that forms a part of this ink room, and the piezoelectric device combined with this elastic member, and carries out the variation rate of the aforementioned elastic member by the aforementioned piezoelectric device, and the ink pressure of the ink interior of a room is heightened [print head], and makes an ink drop breathe out from the aforementioned nozzle

The ink-jet formula print head characterized by the thing which carry out the aforementioned contact of the variation in the distance of the aforementioned elastic member and the aforementioned piezoelectric device, and which was established for amendment pars intermedia material for every portion at the portion to which the aforementioned piezoelectric device contacts the aforementioned elastic member.

[Claim 2] The width of face of the aforementioned pars intermedia material in the direction of a list of the aforementioned piezoelectric device is an ink-jet formula recording head according to

claim 1 characterized by being narrower than the width of face of the aforementioned elastic member and the aforementioned piezoelectric device, and fixing adhesion.

[Claim 3] The manufacture method of the ink-jet formula print head characterized by applying adhesives in the shape of a thin film, imprinting the thin layer of the aforementioned adhesives in the manufacture method of an ink-jet formula print head according to claim 1 or 2 to the aforementioned elastic member by which junction fixation is carried out, the aforementioned piezoelectric device, or the formed aforementioned pars intermedia material, pressing the aforementioned elastic member and the aforementioned piezoelectric device, and fixing.

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention breathes out an ink drop according to a printing signal, and relates to the recording head and its manufacture method of the on-demand type ink jet printer which forms an ink image on record media, such as the recording paper.

[0002]

[Description of the Prior Art] As shown in Japanese patent official report Japanese Patent Publication No. No. 45985 [two to], and JP,2-52625,B, the so-called recording head of the on-demand type ink jet printer which makes an ink drop fly according to a printing signal makes the other end of the piezoelectric device by which the end was fixed to the pedestal contact the elastic wall of the container which forms an ink room through the leg, and is constituted. the member which adjoins the member from which this leg constitutes an elastic wall -- translational motion in alignment with the bearing means of inner cylindrical opening is carried out According to the technology of this official report, a piezoelectric device is shrunk, ink room volume is increased, ink room volume is decreased by expanding a piezoelectric device again, and ink is breathed out as a drop from the nozzle. Furthermore, the composition of this technology has taken the structure of carrying out the line contact of the leg to a bearing means, and making it supporting.

[0003]

[Problem(s) to be Solved by the Invention] The size of a piezoelectric device or an ink room becomes small, so that miniaturization of a recording head and densification are attained. the composition of the above-mentioned official report -- a leg member and leg insertion bearing composition -- it is the structure which carries out the laminating of the member of complicated configurations, such as a member, and it is very difficult to manage the size of the miniaturized each part material with high precision, and to manufacture it That is, it has the trouble that it is difficult to acquire the contact state of the leg and the leg insertion bearing composition member which transmit the generating force from a piezoelectric device for required accuracy in two or more ink regurgitation equipments.

[0004] moreover, the leg mutual [of ink regurgitation equipment] in transfer of the generating force from a piezoelectric device, and multiple -- the same leg insertion bearing composition -- a member -- it has the trouble of interfering in order to carry out translational motion inside

[0005] Furthermore, the rigid lowered piezoelectric device which became small [a size] is made included in the regular position, the load to the aforementioned transection direction to a piezoelectric device is added, and the alignment at the time of arranging in a piezoelectric device and the leg the alignment or the engagement means of a piezoelectric device and the piezoelectric device to the leg structure which prevents the lateroduction of the transection direction to the piezoelectric-device major axis of a piezoelectric device by the coupling means of the leg has the trouble of spoiling the reliability of a piezoelectric device.

[0006] It has the trouble that the rigidity of a bond part is low since mechanical coupling means are moreover used between the leg and the elastic wall, and the high-speed responsibility of ink **** is not obtained.

[0007] Then, the overall purpose of this invention is to offer the joint structure where it was improved between the piezoelectric transducer and the elastic wall.

[0008] Other purposes of this invention are to offer the cheap joint method.

[0009] Other purposes of this invention are to offer the joint structure and the joint manufacture method of mass-producing easily.

[0010] It is in other purposes of this invention offering the joint method that a uniform performance can be demonstrated with two or more ink regurgitation equipments with little piezoelectric-device generating force loss.

[0011] Other purposes of this invention are to offer the joint structure which prevents a mutual interference of ink regurgitation equipment.

[0012] Other purposes of this invention are to offer the joint method of having reliability.

[0013] Other purposes of this invention are to offer the joint method which the high-speed responsibility of the ink regurgitation has.

[0014]

[Means for Solving the Problem] The ink room which the ink-jet formula print head of this invention opens for free passage with a nozzle and this nozzle, It has the elastic member which forms a part of this ink room, and the piezoelectric device combined with this elastic member. In the ink-jet formula print head which carries out the variation rate of the elastic member by the piezoelectric device, and the ink pressure of the ink interior of a room is heightened [print head], and makes an ink drop breathe out from a nozzle It is characterized by the thing which contact the portion to which a piezoelectric device contacts an elastic member in the variation in the distance of an elastic member and a piezoelectric device and which was established for amendment pars intermedia material for every portion.

[0015] Moreover, in the starting ink-jet formula print head, the width of face of the pars intermedia material in the direction of a list of a piezoelectric device is narrower than the width of face of an elastic member and a piezoelectric device, and is characterized by fixing adhesion.

[0016] Moreover, in the manufacture method of the starting ink-jet formula print head, adhesives are applied in the shape of a thin film, the thin layer of adhesives is imprinted to the elastic member by which junction fixation is carried out, a piezoelectric device, or the formed pars intermedia material, and it is characterized by pressing an elastic member and a piezoelectric device and fixing.

[0017]

[Example] Drawing 1 is the perspective diagram showing the composition of one example of this invention, and disassembles each part article after assembly. Drawing 2, drawing 3, drawing 4, and drawing 5 show the fragmentary sectional view which drew this example on the detail more, the fragmentary sectional view which rotated the aforementioned fragmentary sectional view of this example 90 degrees, the partial perspective diagram which looked at this example from the lower part, and the part plan which looked at this example from right above, respectively. In addition, drawing 5 shows the state where the component part was penetrated one by one from the top. The fragmentary sectional view drawing 13 explains the conventional trouble to be, and drawing 6 show the fragmentary sectional view explaining the effect in the structure of this invention. Drawing 9 and drawing 10 show the fragmentary sectional view for explaining one example of the manufacture method of an ink room. Drawing 11 shows the fragmentary sectional view for explaining the manufacture method which forms pars intermedia material based on the composition of the example of this invention. Drawing 12 shows the fragmentary sectional view for explaining the manufacture method of this invention based on the example of this invention. Drawing 7 and drawing 8 show the fragmentary sectional view for explaining other examples of this invention.

[0018] In these drawings, 1 is a nozzle substrate. Two or more nozzles 2 are formed in the nozzle substrate 1. 3 is a cavity formation substrate. The cavity formation substrate 3 is pinched by the elastic member 8 used as the nozzle substrate 1 and an elastic wall, and forms a reservoir 4 and the ink room 5. An elastic member 8 accomplishes the laminated structure which consists of a sheet metal 6 and wall material 7. After adhesion junction is carried out one by one and an elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 form a cavity, they form in an elastic member 8 side the pars intermedia material 10 mentioned later, and adhesion junction is carried out on the head frame 11.

[0019] this invention is explained based on drawing 1. The piezoelectric device 22 used as the driving source of the ink drop regurgitation fixed the whole surface of the abbreviation half of the longitudinal direction to standing ways 21, and has joined the nose of cam 50 of the half which

does not fix to the pars intermedia material 10. The flow circuit pattern 24 of a positive electrode and a negative electrode is given to standing ways 21, and the electric field controlled by the control board 13 are given to a piezoelectric device 22 through a leadframe 25. 11 is a head frame. 12 is the installation hole which penetrates the inside of the head frame 11, and supports standing ways 21 to carry out X of a piezoelectric device 22, and alignment (to refer to the XYZ coordinate of drawing 1) of the direction of Y. In addition, the Z direction of a piezoelectric device 22 carries out alignment of the nose of cam 50 of a piezoelectric device 22 in contact with the pars intermedia material 10 after joining the zygote which joined the pars intermedia material 10, the elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 to the head frame 11.

[0020] 31 is an ink supply pipe which supplies ink 51 from an ink reservoir (not shown). Pressing junction of the ink supply pipe 31 is carried out at the head frame 11. Ink passage is open for free passage through the ink end connection 32 in the head frame 11, and the ink connection mouth 33 in an elastic member 8 with the reservoir 4 of the cavity formation substrate 3, and also the ink room 5. The above is outline composition.

[0021] According to drawing 2 and drawing 3, structure is described in more detail. Drawing 2 is a fragmentary sectional view when disconnecting one piezoelectric device of the piezoelectric device 22 which carries out two or more parallel (the direction of X of drawing 1) from a center in the direction of Y of drawing 1. Wall material 7a which the piezoelectric device 22 of an elastic member 8 contacts through the pars intermedia material 10 is aiming at rigid reinforcement to the sheet metal 6 in order to obtain uniformly as much as possible the amount of displacement of the elastic wall of the ink room 5 at a large area, since the ink room cross section is larger than the contact section cross section of a piezoelectric device 22. One electrode 42 of one electrode 41 and others has countered. [piezoelectric device / 22] Electrical connection of the electrode 41 is carried out to the circuit pattern 24 on standing ways 21 simultaneously with junction. Electrical connection of other electrodes 42 is carried out to the circuit pattern 24 on standing ways 21, and the electrode contrary to especially the electrode 41 with the common board 23. The circuit pattern 24 and the control board 13 were connected with the leadframe 25, and the connection place is fixed with solder 26, respectively. In addition, standing ways 21 are in the state to which the piezoelectric device 22 contacted the pars intermedia material 10, and junction fixation is carried out at the head frame 11. That is, alignment of the Z direction of a piezoelectric device 22 is carried out by the pars intermedia material 10. The flat surface 60 of the head frame 11 which contacts the wall material 7 is finished with high precision by meanses, such as flat-surface polish.

[0022] Drawing 3 is a fragmentary sectional view when cutting from a center in the direction of X of drawing 1 of the piezoelectric device 22 arranged in parallel. [two or more] The nozzle substrate 1, the cavity formation substrate 3, and an elastic member 8 are the laminated structures which carried out adhesion junction, in order to carry out adhesion junction, the wall material 7 of an elastic member 8 needs to apply a junction pressure to wall 3e which contacts the nozzle substrate 1 and an elastic member 8 and which separates between an ink room, and wall material 7a which transmits the generating force from a piezoelectric device 22 arranges wall material 7b independently.

[0023] On the other hand, the ink room 5 and reservoir 4 with which it fills up with ink 51 are formed like drawing 5 by the cavity formation substrate 3, the nozzle substrate 1, and the elastic member 8. Although the cavity formation substrate 3 can be made with etching processing of glass, the laminating of a sheet metal, exposure formation of a photopolymer, injection molding of a resin, etc., the photopolymer cheap in cost is used for it by this example. The wrap nozzle substrate 1 consists the upper surface of the cavity formation substrate 3 of a stainless steel plate with which every one nozzle 2 was opened in two or more ink rooms 5, respectively and which is about 0.1mm by press working of sheet metal. The nozzle substrate 1 can be made also by the nickel-electroforming processing method. Moreover, the structure which carried out the laminating of the wall material 7 formed in the thickness of about 10-100 micrometers by the said processing method to the sheet metal 6 by which the wrap elastic member 8 formed the inferior surface of tongue of the cavity formation substrate 3 in the thickness of 5 micrometers

or less by the nickel-electroforming processing method is made. The wall material 7 can acquire a required configuration easily by applying a resist. Although a sheet metal 6 is so desirable that it is thin in order to tell expansion and contraction of a piezoelectric device 22 efficiently to the ink room 5, the ink 51 in the ink room 5 must not ooze out. It is because ink 51 adheres between one electrode 41 of a piezoelectric device 22, and one of other electrodes 42, and to a control board 13 and it short-circuits electrically, when ink 51 presents conductivity. Moreover, resins, such as a film, can also be substituted for a sheet metal 6. Although it will become simple as composition if a piezoelectric device 22 is directly joined to a sheet metal 6, this is not made for the following reasons. The piezoelectric device which adjoins if an electrode 41 contacts a sheet metal 6 as one reason as shown in drawing 2 will connect too hastily. Temporarily, ink 51 will be joined by electric field when an electrode 41 side is used as a common electrode. This leads to ink 51 ionizing with time and causing degradation of reliability. Then, by allotting insulating member, i.e., a photopolymer, to the pars intermedia material 10, it will be released from the above-mentioned problem and the flexibility of the wiring for controlling a piezoelectric device 22 will increase. Another reason has the cross-section configuration of a piezoelectric device 22, and the cross-section configuration of the ink room 5 in differing from a cost side and the reasons of manufacture, as shown in drawing 5. In case a piezoelectric device 22 carries out the pressurization and decompression of the ink room 5, as this is shown in drawing 5, the length (b) of an elastic member 8 which can be displaced is too short, and it cannot fully bend, but it will elapse and the length (b) of an elastic member 8 which can be displaced conversely will absorb the pressure [being long] to generate. Therefore, in order to carry out the pressure transfer of the variation rate of a piezoelectric device 22 efficiently at the ink room 5, the middle transfer member which can secure a length (b) (b) appropriately is needed. Wall material 7a which has rigidity from the reason for the above is needed. Therefore, wall material 7a is designed somewhat smaller than the plane of projection of the ink room 5 so that it may bend as shown in drawing 5, and an amount can be secured. The form which shows wall material 7a in drawing 4 by the electroforming method is made. Moreover, as shown in drawing 6, the pars intermedia material 10 is formed for margin increase of the alignment of the nose of cam 50 of a piezoelectric device 22, and wall material 7a, and, as for the end face of wall material 7a which is an insular part, the nose of cam 50 of a piezoelectric device 22 is joined to this.

[0024] Here, ink drop discharging is explained using drawing 2. According to a printing signal, electric field are impressed to one electrode 41 of a piezoelectric device 22, and one of other electrodes 42 through a leadframe 25 and a circuit pattern 24 from a control board 13. It is going to contract the piezoelectric device 22 to which electric field were impressed to a longitudinal direction (this drawing vertical direction). At this time, the lower half of a piezoelectric device 22 has fixed to the standing ways 21 held at the head frame 11, and cannot carry out contraction displacement. On the other hand, the upper half of a piezoelectric device 22 carries out contraction displacement, without receiving other restraints, and pulls an elastic member 8 through the pars intermedia material 10 with the shrinkage force. The sheet metal 6 of the elastic member 8 pulled by the piezoelectric device 22 through the pars intermedia material 10 bends below, and, as a result, the volume of the ink room 5 expands. If the ink room 5 expands, ink 51 will flow through ink feed-hopper 3c from a reservoir 4. Subsequently, if the electric field of a piezoelectric device 22 are canceled, it will elongate to the original length and a piezoelectric device 22 will compress the ink room 5. ** which breathes out an ink drop from a nozzle 2 by this pressure. Wall material 7a of the pars intermedia material 10 and an elastic member 8 which tells the variation rate of a piezoelectric device 22 to the ink room 5 pressurizes and decompresses the ink room 5 uniformly, leaving the deflection section of a sheet metal 6, since it is somewhat smaller than the plane of projection of the ink room 5, as mentioned above.

[0025] By the way, in the conventional example of joint structure which does not form the pars intermedia material 10 of this invention, two or more ink rooms 5 are close, and the leg 27 is arranged in an one to one. Piezoelectric-device 22a and the leg 27 are joined directly [after / contact], in order to abolish loss at the time of generating force transfer. However, by the alignment of the structure where a size is extremely small, as shown in drawing 13, an edge

starts the leg 27 which piezoelectric-device 22a adjoins, and they are the contiguity ink rooms 5, 5, and 5.... There is a possibility of interfering in between. moreover, elastic member 8a which is the oscillating section in adhesives being applied so much partially -- bearing composition -- the danger of being solidified with a member 28 is also high. Therefore, in order to join piezoelectric-device 22a and elastic member 8a, it is necessary for this gap to apply necessary minimum adhesives. After applying generally as the adhesion method so that it may not come out of the adhesives of a constant rate with a coating thickness rose to each application section at piezoelectric-device 22a or elastic member 8a, both are held in the state where it contacted and these adhesives are stiffened. Possibility that restrictions on a process will be greatly realized on structure except [this], for example although it is possible to be filled up with the moderate amount [a / elastic member 8/ piezoelectric-device 22a and] according to each gap of piezoelectric-device 22a and elastic member 8a after contact is very small. Then, the method of applying, while managing the adhesives of a constant rate will be taken.

[0026] When the alignment of piezoelectric-device 22a and elastic member 8a is difficult with the structure where a size is extremely small, in the junction state of adhesives, a large state with a rose will be formed like 9a, 9b and 9c of drawing 13, and Here, although three typical types are illustrated, actual much more junction states have arisen. 9a showed the junction state which is not a problem, was stabilized as junction in the dynamic pressure transfer to elastic member 8a from piezoelectric-device 22a, and has hardened it to it. It is because the adhesives on this, i.e., elastic member, 8a or piezoelectric-device 22a are maintained at the proper quantity. On the other hand, 9b shows the state where it joined to the leg 27 which the leg 27 which should be joined adjoins. In this state, **** of the ink from the unnecessary ink room 5 besides the purpose will arise. that 9c is the excess of an adhesives coverage, and nozzle substrate 1a, 3d of cavity formation substrates, elastic member 8a and bearing composition -- the rose and curvature of the thickness direction which are produced by the manufacture process of a member 28 -- the gap of the leg 27 and piezoelectric-device 22a -- narrow -- a bird clapper -- originating -- bearing composition -- the state where the member 28 is also joined is shown this state -- again -- the leg 27 and bearing composition -- piezoelectric-device 22 from relation in which member 28 must operate smoothly a -- a variation rate -- in a direction, the two aforementioned member cannot form big ****, therefore it will be easy to incorporate the adhesives B on piezoelectric-device 22a in a wall material 7a row easily like 9c, and expansion and contraction of piezoelectric-device 22a will be prevented therefore -- in order to prevent the outflow of Adhesives B, while changing into a suitable and uniform state the gap of the half nose of cam 50 and the contact side of the leg 27 which piezoelectric-device 22a does not fix -- the leg 27 and bearing composition -- it is important to distinguish between the application height ha grade of adhesives at least with a member 28

[0027] On the other hand, drawing 6 is a fragmentary sectional view explaining the effect by having formed the pars intermedia material 10 carried out by this invention. moreover, the leg 27 and bearing composition -- **** structure is shown for the cure to friction between members 28. In this drawing, the pars intermedia material 10 is formed by the method of mentioning later, and the state where it was joined to piezoelectric-device 22a is shown. As shown in this drawing, pars intermedia material amends the rose and camber of the thickness direction by the manufacture process of 10d, 10e, nozzle substrate which is 10f and was mentioned above 1a, 3d of cavity formation substrates, and elastic member 8b, and as 9d, 9e, and 9f show, it forms the moderate gap. Moreover, the level difference of the height of the pars intermedia material 10 and contiguity wall material 8b is harnessed by the manufacture method mentioned later, it is stabilized and the adhesion state is formed. Drawing the adhesives B on wall material 8b which adjoins when Adhesives B are moreover applied to up to wall material 8b in piezoelectric-device 22a is lost.

[0028] In addition, besides the above-mentioned example, the pars intermedia material 14 can also be formed in a piezoelectric-device 22 side like drawing 7. Moreover, like drawing 8, the pars intermedia material 16 can be formed in a piezoelectric-device 22 side, and the pars intermedia material 15 can also be formed in an elastic member 8 side.

[0029] Next, according to drawing 9 and drawing 10, the manufacture method of the zygote of an

elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 is described. Drawing 9 and drawing 10 show the cross section seen from [of a piezoelectric device 22] two or more parallel. Although there are methods, such as press working of sheet metal, electrocasting fabrication, and etching, as a manufacturing method of the cavity formation substrate 3, it is a process using the easiest photopolymer film here, and the cavity formation substrate 3 is divided and formed in each of the nozzle substrate 1 and an elastic member 8 at the two sections, and how to weld and make behind to the two sections which carried out division formation is explained. First, drawing 9 is used and the cavity formation by the side of the nozzle substrate 1 of the cavity formation substrate 3 is explained. The photopolymer film (it is called a dry film below) 61 is laminated like the above-mentioned in the nozzle substrate 1 processed by press working of sheet metal or the electroforming method. Next, the glass mask 62 in which the pattern which exposes ultraviolet rays, and the pattern which is not exposed were formed is arranged on the dry film 61 side, and it exposes by irradiating ultraviolet rays. After exposure, the portion hardened by exposure and the unexposed portion which is not exposed are formed on the dry film 61. Next, by developing negatives, an unexposed portion is removed and the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1 is completed.

[0030] A zygote 80 is completed by forming cavity formation substrate 3b on the elastic member 8 into which the elastic member 8 side as well as the aforementioned cavity formation substrate 3a was processed by the electroforming method like drawing 10 on the other hand. And when the completion object of a cavity contacts and welds both of the zygote 80 of the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1, cavity formation substrate 3b, and an elastic member 8 at the temperature of 150–170 degrees C, the cavity formation substrate completion object 90 is manufactured. Although a dry film front face is welded by heat at this time, the amount of crushing of a dry film is determined by welding pressure and time. Moreover, it becomes important, when that pressurization accomplishes equally lessens with [of the amount of crushing of a dry film] a rose. Then, wall material 7b is arranged in the position where cavity formation substrate 3a and cavity formation substrate 3b contact for the purpose of ***** etc., and stabilization with the rose of the amount of crushing of a dry film is attained. Therefore, adjoining ink rooms 5, 5, and 5 Wall material 7b is arranged in between, an interval with wall material 7a becomes dense, and a high-density array becomes difficult. Therefore, it becomes important to form the pars intermedia material 10 at the time of junction to a piezoelectric device 22. Moreover, the imbalance of the amount of crushing tends to happen in fact depending on how to allot the existence of the weld meat on a dry film, i.e., a pattern. Moreover, in the cooling process from heating at the time of weld to ordinary temperature, it becomes easy to generate a camber. From the above reason, it is easy to generate with [of thickness h of the cavity formation substrate completion object 90] a rose at the time of manufacture. Therefore, also in with [of a piezoelectric device 22 and an elastic member 8] a gap rose, the pars intermedia material 10 will play an important role.

[0031] Drawing 11 shows the process which forms the aforementioned pars intermedia material 10. 90 is a cavity formation substrate completion object. First, fluid matter 10a which forms the pars intermedia material 10 in the elastic member 8 side of the cavity formation substrate completion object 90 is applied. Priming may be performed to an elastic member 8 for the purpose of the improvement in the adhesion force before an application if needed. Although a photopolymer, thermosetting resin, and a room-temperature-setting nature resin are raised, as for fluid matter 10a, polyester resin, acrylic resin, an epoxy resin, an APR resin, and various resins are used especially. In this example, it can treat comparatively easily and polyester resin (photopolymer) cheap also in cost is used. Next, the PET film aiming at a mold-release characteristic is laid in the portion which makes a fixed distance estrange from the portion of an elastic member 8 which serves as a convex most and which prepared the gap member (not shown) more than imprint adhesives height h_a (drawing 12) to the below-mentioned pars intermedia material 10 top at least at the range [at least] larger than fluid matter 10a. Next, the glass mask 91 used as flat criteria is laid on the aforementioned film.

[0032] The pattern is arranged on this glass mask 91 in order to form the exposure section and

the unexposed section alternatively to fluid matter 10a. Furthermore, even if there are few these glass masks, the flatness of about 0.1–0.2 micrometers is made to one side by the side of a film by polish processing. After laying this glass mask 91, it exposes by irradiating ultraviolet rays with the wavelength of about 300–400nm. Since it is hard to expose fluid matter 10a to 400nm or more of visible rays, a dark room and a special facility are unnecessary. After the aforementioned exposure, 2 ****s of fluid matter 10a are carried out, the exposed section causes and hardens a chemical change and the unexposed section is maintaining the fluid state. A portion fluid in the unexposed section is removed in this state. Since fluid matter 10a is easily removable with a weak lye or water, work is safe and harmless. Moreover, a postexposure can also be carried out if needed in order to stiffen a part for a hard spot still more certainly. Moreover, the temperature of 60–80 degrees C may be applied for the purpose of dryness of the component swollen at the time of unexposed section removal. By the above method, the pars intermedia material 10 can be formed and the highly precise pars intermedia material 10 of the same grade as the aforementioned glass mask 91 can be formed about flat-surface precision. In addition, the highly precise pars intermedia material 10 can be similarly formed about the aforementioned thermosetting resin or a room-temperature-setting nature resin also except this example.

[0033] Next, the manufacture method that an adhesion coverage is stabilized and the pars intermedia material 10 and piezoelectric device 22 which were formed on the cavity formation substrate completion object 90 arranged with high density according to drawing 12 can be obtained easily is explained. The flatness grade of a glass mask is made to the flat-surface precision of the pars intermedia material 10 on wall material 7a of the elastic member 8 formed by the aforementioned manufacture method as aforementioned. However, it is about 1–3 micrometers with [with the aforementioned pars intermedia material 10] a gap rose by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix. It is stored with the gap rose in the minimum until now. Then, you have to absorb with a remains rose in the height h_a of Adhesives B. Therefore, you have to apply the height h_a of Adhesives B uniformly on the pars intermedia material 10 by the grade which is not protruded into a sheet metal 6 from at least 4 micrometers even if many. As the method of an adhesives B constant-rate application, although there are a spin coat, spray printing, octopus printing, a monotonous imprint, and screen-stencil, since the flash to a sheet metal 6 is strict prohibition, with this structure, a spin coat, spray printing, and screen-stencil cannot be used. Moreover, a sheet metal 6 is very as thin as 5 micrometers or less, and in octopus printing, since a pressure is added, it cannot be used, being able to draw destruction of a sheet metal 6. Although one side generally imprints to a transferred object about a monotonous imprint using the plate which has a highly precise flat-surface precision, with this structure, although it is a minute amount about a small amount of adhesives B, it must imprint to the pars intermedia material 10 which has with a flatness rose, and if it takes that the upper pressure cannot be applied into consideration, a monotonous imprint will serve as a method unsuitable for a constant-rate application. Then, to the structure of this invention, the application whose film harnessed the feature which follows with [of flatness] a rose, and managed the imprint height h_a with high precision by the film imprint which is one of the decalcomania methods is performed.

[0034] As shown in drawing 12, the manufacture method is close in the 5 micrometers – 20 micrometers film of a polyimide by this example to the plate which has made about 0.1–0.2 micrometers to one side, manages the height on the film of Adhesives B in the upper part, and it installs the spacer 65 which restricts an area required for an imprint. Adhesives B are dropped at application within the limits of this spacer, an edge has flat nature in a line, and writes the excessive adhesives B to it, and it eliminates with a board. By performing this process of a series of quickly, adhesives B height of the same grade as spacer ** is obtained. And after eliminating a spacer, the film with which Adhesives B are applied is put on up to the pars intermedia material 10 using the surface tension of Adhesives B. Since the film with which Adhesives B are applied is flexible, it is followed in the shape of [of the cavity formation substrate completion object 90] surface type, and can be drawn near according to the viscosity

of Adhesives B. At this time, the film is gradually put on up to the pars intermedia material 10 and wall material 7b so that air bubbles may not mix in the adhesives B application section. The portion which Adhesives B contacted will obtain the adhesives B imprinted by the uniform height h_a , if this film is removed. Since a film imprint follows the configuration of a transferred object irrespective of the flatness of a transferred object, the amount of imprints of Adhesives B is uniformly imprinted also in which imprint portion. A front face is rectangular continuation, and since the pars intermedia material 10 serves as a height, as for this transferred object, the little application of the adhesives B is carried out at the side. Therefore, the adhesives meniscus configuration at the time of junction results to the side of the pars intermedia material 10, and can obtain junction high intensity. The feature of a film imprint is doubling the rigidity of a film, and the kind of film in the shape of [of a transferred object] surface type, choosing them, and choosing what was suitable for the surface area of a transferred object, and the surface state in the principal component of adhesives, and viscosity, and the adhesives application of the parts of the complicated shape of various surface type and surface roughness can carry it out to coating thickness homogeneity easily. As mentioned above, like drawing 6, by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix, piezoelectric-device 22a is stabilized in the adhesives B of the uniform height h_a on the easy pars intermedia material 10 obtained by the method of becoming, without [without it joins to wall material 7b, and] adhesives flowing out to a sheet metal 6, and is joinable to wall material 7a at them.

[0035] The joint structure of the piezoelectric device 22 and elastic member 8 which were formed as stated above can be transmitted to the ink room 5 without loss of the generating force of a piezoelectric device 22. As a feature, the joint structure between a piezoelectric device 22 and an elastic member 8 is in each ink **** equipment not to receive the restraint from from [else] at all. Moreover, the pars intermedia material 10 is a resin, a light thing and by having stabilized the upper adhesives coverage and having formed the pars intermedia material 10, a large margin can be taken to alignment and a piezoelectric device 22 and an elastic member 8 can be joined to contact exactly easily.

[0036]

[Effect of the Invention] As explained above, it is the ink-jet formula print head of this invention. A nozzle, this nozzle, an ink room open for free passage, and the elastic member that forms a part of this ink room, In the ink-jet formula print head which it has the piezoelectric device combined with this elastic member, and carries out the variation rate of the elastic member by the piezoelectric device, and the ink pressure of the ink interior of a room is heightened [print head], and makes an ink drop breathe out from a nozzle Since **** with a contiguity member is manageable with pars intermedia material by [which contact the portion to which a piezoelectric device contacts an elastic member in the variation in the distance of an elastic member and a piezoelectric device] having prepared amendment pars intermedia material for every portion, Junction to contiguity wall material can be prevented, the large margin of the alignment to the elastic member of a piezoelectric device can be taken in the direction of a flat surface, and reliability is acquired in order not to add the load according [a piezoelectric device] to combination to the crossing direction of the displacement direction. Consequently, the variation rate of a piezoelectric device can be told to an ink room now faithfully and efficiently, and it has the effect that the high-density head by which the ink **** property of having high-speed responsibility was stabilized can be obtained.

[0037] Moreover, the width of face of the pars intermedia material in the direction of a list of a piezoelectric device is narrower than the width of face of an elastic member and a piezoelectric device, in the starting ink-jet formula print head, when adhesion is fixed, it is the joint structure between the piezoelectric device of the ink **** equipment arranged by being close in parallel, and wall material, and can prevent rigid-body-ization of an and also [it is based on an adhesives outflow], and enables the high-density array of ink **** equipment. Moreover, in order to combine between each part material by junction firmly, it has the effect that high-speed responsibility is realizable.

[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram showing the composition of one example of this invention.

[Drawing 2] It is the fragmentary sectional view of an example same as the above.

[Drawing 3] It is the fragmentary sectional view of the field which the example same as the above rotated 90 degrees.

[Drawing 4] It is the partial perspective diagram which looked at the example same as the above from the lower part.

[Drawing 5] It is the plan which looked at the example same as the above from right above.

[Drawing 6] Book

[Drawing 7] It is the fragmentary sectional view of other examples of this invention.

[Drawing 8] It is the fragmentary sectional view of other examples of this invention.

[Drawing 9] It is drawing showing one process of one example of this invention.

[Drawing 10] It is drawing showing one process of an example same as the above.

[Drawing 11] It is drawing showing one process of an example same as the above.

[Drawing 12] It is a fragmentary sectional view explaining the manufacture method of this invention.

[Drawing 13] It is a fragmentary sectional view explaining the problem of the conventional example.

[Description of Notations]

1 1a Nozzle substrate

3 3d Cavity formation substrate

5 Ink Room

6 Sheet Metal

7, 7a, 7b wall material

8 8a Elastic member

9a, 9b, 9c, 9d, 9e, 9f Flow hardening state of adhesives

10, 10d, 10e, 10f, 14, 15, 16 Pars intermedia material

10a Fluid matter

11 Head Frame

12 Installation Hole

21 Standing Ways

22 22a Piezoelectric device

23 Common Board

24 Circuit Pattern

25 Leadframe

27 Leg

28 Bearing Composition -- Member

31 Ink Supply Pipe

32 Ink End Connection

33 Ink Connection Mouth

51 Ink

60 Head Frame Flat Surface

61 Photopolymer Film (Dry Film)

62 Glass Mask

90 Cavity Formation Substrate Completion Object

91 Glass Mask (Basis Jumpei Board)

[Translation done.]

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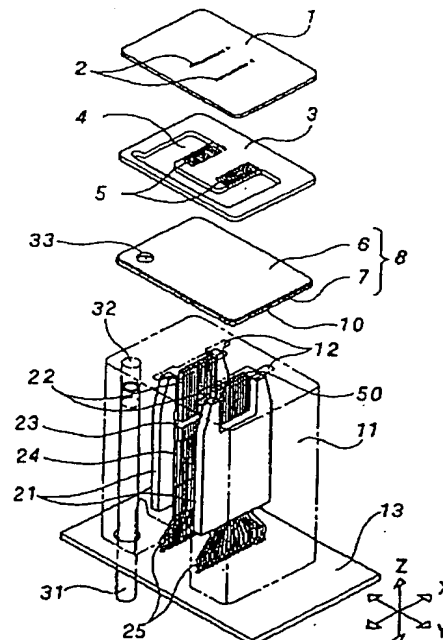
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(54)【発明の名称】 インクジェット式印字ヘッド及びその製造方法

(57)【要約】

【目的】 圧電素子22をより高密度配列するために、
圧電素子22及び弾性部材8より狭い幅で弾性部材8上
に中間部材10を配設することで、隣接壁部材との段差
を活かし隣接部材との干渉を防ぎ、位置合わせのマー
ジンを拡大できる、また複数圧電素子22の発生力が損失
なく安定して弾性部材8へ伝達できる。その上接着剤B
を安定して容易に適量管理して塗布を行い、接着剤の流
れ出しを防止しを可能にすることを目的とする。

【構成】 インク室5の一部を形成する弾性部材8を圧
電素子22により変位させ、ノズル2からインク滴を吐
出させるインクジェットヘッドにおいて、前記弾性部材
8と圧電素子22の間に中間部材10を設け、中間部材
10を圧電素子22と接合した構成からなる。



【特許請求の範囲】

【請求項1】 インク室の一部を形成する弾性部材と、これに一对一に対応、配設される圧電素子とは結合構造をとり、前記弾性部材は前記圧電素子によって変位し、インク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、前記弾性部材と前記圧電素子が当接する部分に中間部材を設け、かつ前記圧電素子複数並列方向における前記中間部材の幅は、前記弾性部材及び前記圧電素子の幅より狭く、接着により固定されていることを特徴とするインクジェット式印字ヘッド。

【請求項2】 請求項1記載のインクジェット式印字ヘッドにおいて、接着剤を薄膜状に塗布し、前記接着剤の薄層を、接合固定される前記弾性部材あるいは前記圧電素子あるいは形成された前記中間部材に転写し、前記弾性部材と前記圧電素子とを押圧、固定することを特徴とするインクジェット式印字ヘッドの製造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、印字信号に応じてインク滴を吐出して、記録紙等の記録媒体上にインク像を形成するオンデマンド型インクジェット式プリンタの記録ヘッド及びその製造方法に関する。

【0002】

【従来の技術】印字信号に応じてインク滴を飛翔させる、いわゆるオンデマンド型インクジェット式プリンタの記録ヘッドは、日本特許公報特公平2-45985号や特公平2-52625号に示されたように、一端が基台に固定された圧電素子の他端を、インク室を形成する容器の弾性壁に、脚部を介して当接させて構成される。この脚部は弾性壁を構成する部材に隣接する部材内の円柱形開口の軸受手段に沿った並進運動をしている。同公報の技術によると、圧電素子を収縮させてインク室体積を増大し、再び圧電素子を伸長させることでインク室体積を減少させインクをノズルから液滴として吐出している。更に同技術の構成は、脚部を軸受手段に線接触させて支持させる構造をとっている。

【0003】

【発明が解決しようとする課題】記録ヘッドの小型化、高密度化を図るほど圧電素子やインク室の寸法は小さくなる。前出の公報の構成では、脚部部材や脚部挿入軸受構成部材等、複雑なる形状の部材を積層する構造であり、小型化した各部材の寸法を高精度に管理し製造することが非常に困難である。つまり圧電素子からの発生力を伝達する脚部と脚部挿入軸受構成部材との接触状態を複数のインク吐出装置において必要精度を得ることが困難であるという問題点を有する。

【0004】また、圧電素子からの発生力の伝達が、インク吐出装置の相互間で、複数の脚部を同一の脚部挿入軸受構成部材内で並進運動させるために干渉するという

問題点を有する。

【0005】更に、圧電素子と脚部の結合手段で、圧電素子の圧電素子長軸に横断方向の側方運動を阻止する脚部構造への圧電素子の位置合わせまたは係合手段を圧電素子と脚部に配設した場合の位置合わせは、寸法の小さくなった、剛性の低下した圧電素子を定位置へ組み込ませることとなり、圧電素子への前記横断方向への負荷が加わり、圧電素子の信頼性を損なうという問題点を有する。

【0006】その上、脚部と弾性壁間に機械的結合手段を用いているため結合部の剛性が低く、インク吐出の高速応答性が得られないという問題点を有する。

【0007】そこで、本発明の全体的な目的は、圧電変換器と弾性壁との間の改良された結合構造を提供することにある。

【0008】本発明の他の目的は安価な結合方法を提供することにある。

【0009】本発明の他の目的は容易に量産できる結合構造かつ結合製造方法を提供することにある。

【0010】本発明の他の目的は圧電素子発生力損失の少ない、複数のインク吐出装置で均一なる性能の発揮できる結合方法を提供することにある。

【0011】本発明の他の目的はインク吐出装置の相互間の干渉を防ぐ結合構造を提供することにある。

【0012】本発明の他の目的は信頼性を有する結合方法を提供することにある。

【0013】本発明の他の目的はインク吐出の高速応答性の有する結合方法を提供することにある。

【0014】

【課題を解決するための手段】本発明のインクジェット式印字ヘッドは、インク室の一部を形成する弾性部材と、これに一对一に対応、配設される圧電素子とは結合構造をとり、前記弾性部材は前記圧電素子によって変位され、インク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、前記弾性部材と前記圧電素子との少なくとも一方に、前記弾性部材と前記圧電素子とが当接する部分に中間部材を設け、かつ前記圧電素子複数並列方向における前記中間部材の幅は、前記弾性部材及び前記圧電素子の幅より狭く、各部材は接着により固定されていることを特徴とする。更に、その製造方法においては、接着剤を薄膜に塗布し、前記薄膜上に塗布された接着剤の薄層を、接合固定される前記弾性部材あるいは前記圧電素子あるいは形成された前記中間部材に転写し、前記弾性部材と前記圧電素子とを押圧、固定することを特徴とするインクジェット式印字ヘッドの製造方法。

【0015】

【実施例】図1は本発明の一実施例の構成を示す斜視図であり、組立後に各部品を分解したものである。図2、図3、図4、図5はそれぞれ、同実施例をより詳細に描

いた部分断面図、同実施例の前記部分断面図を90度回転した部分断面図、同実施例を下方より見た部分斜視図、同実施例を真上より見た部分平面図を示す。尚、図5は構成部品を上より順次透過した状態を示す。図6は従来の問題点を説明する部分断面図、図7は本発明の構造での効果を説明する部分断面図を示す。図8、図9はインク室の製造方法の一実施例を説明するための部分断面図を示す。図10は本発明の実施例の構成に基づいて、中間部材を形成する製造方法を説明するための部分断面図を示す。図11は本発明の実施例に基づいて、本発明の製造方法を説明するための部分断面図を示す。図12、図13は本発明の他の実施例を説明するための部分断面図を示す。

【0016】これらの図において、1はノズル基板である。ノズル基板1には、複数のノズル2を設けてある。3はキャビティ形成基板である。キャビティ形成基板3は、ノズル基板1と、弾性壁となる弾性部材8とで挟まれて、リザーバ4とインク室5を形成する。弾性部材8は、金属薄板6と壁部材7とからなる積層構造を成す。弾性部材8、キャビティ形成基板3、ノズル基板1は順次密着接合されキャビティを形成した後、後述する中間部材10を弾性部材8側に形成し、ヘッドフレーム11上に密着接合されている。

【0017】図1をもとに本発明を説明する。インク滴吐出の駆動源となる圧電素子22は、その長手方向の約半分の一面を固定台21に固着され、固着されない半分の先端50を中間部材10と接合している。固定台21には正極と負極の導通配線パターン24が施され、リードフレーム25を介して、制御基板13により制御された電界を圧電素子22に与える。11はヘッドフレームである。12はヘッドフレーム11内を貫通する取り付け穴で、圧電素子22のX、Y方向の位置合わせ(図1のXYZ座標参照)をするべく固定台21を支持する。尚、圧電素子22のZ方向は、中間部材10と弾性部材8とキャビティ形成基板3とノズル基板1を接合した接合体を、ヘッドフレーム11に接合後、圧電素子22の先端50を中間部材10に当接して位置合わせする。

【0018】31はインク溜部(図示せず)からインク51を供給するインク供給管である。インク供給管31は、ヘッドフレーム11に圧入接合されている。インク流路は、ヘッドフレーム11にあるインク接続口32と弾性部材8にあるインク連絡口33を経て、キャビティ形成基板3のリザーバ4、更にインク室5と連通している。以上が概略構成である。

【0019】図2、図3に従って、構造について更に詳しく述べる。図2は複数並列(図1のX方向)する圧電素子22の、一本の圧電素子を図1のY方向へ中央より切断したときの部分断面図である。弾性部材8の圧電素子22が中間部材10を介して当接する壁部材7aは、圧電素子22の当接部断面積よりインク室断面積が大き

いたために、インク室5の弾性壁の変位量を可能な限り大面積で均一に得るため、金属薄板6に対して剛性の補強を図っている。圧電素子22は、一方の電極41と他の一方の電極42が対向している。電極41は、固定台21上の配線パターン24に接合と同時に電気接続されている。他の電極42は、共通板23により、固定台21上の配線パターン24、特に電極41に反する電極と電気接続している。配線パターン24と制御基板13とをリードフレーム25で結び、それぞれ接続箇所を半田26で固着している。尚、固定台21は、圧電素子22が中間部材10に当接した状態で、ヘッドフレーム11に接合固定されている。つまり、圧電素子22のZ方向は中間部材10で位置合わせする。壁部材7と当接するヘッドフレーム11の平面60は、平面研磨等の手段により高精度に仕上げられている。

【0020】図3は複数並列する圧電素子22の図1のX方向へ中央より切断したときの部分断面図である。ノズル基板1とキャビティ形成基板3と弾性部材8とは密着接合した積層構造であり、密着接合させるために、弾性部材8の壁部材7はノズル基板1と弾性部材8とに当接する、インク室間を隔てる壁3eに接合圧力を加えることが必要であり、圧電素子22からの発生力を伝達する壁部材7aとは別に壁部材7bを配設する。

【0021】一方、図5のごとくインク51が充填されるインク室5及びリザーバ4は、キャビティ形成基板3とノズル基板1と弾性部材8とで形成される。キャビティ形成基板3は、ガラスのエッチング加工、金属薄板の積層、感光性樹脂の露光形成、樹脂の射出成形等で作ることができるが、本実施例では、コスト的に安価な感光性樹脂を用いている。キャビティ形成基板3の上面を覆うノズル基板1は、プレス加工によって、複数のインク室5にそれぞれ一つずつノズル2が付けられた、0.1mm程のステンレス鋼板からなる。ノズル基板1は、ニッケルの電鍍加工法によっても作ることができる。また、キャビティ形成基板3の下面を覆う弾性部材8は、ニッケルの電鍍加工法で5μm以下の厚さに形成した金属薄板6に、同加工法で10~100μm程度の厚さに形成した壁部材7を積層した構造をなす。壁部材7は、レジストを塗布することで容易に必要な形状を得ることが出来る。金属薄板6は、圧電素子22の伸縮をインク室5に効率良く伝えるために薄いほど好ましいが、インク室5内のインク51がしみ出してはならない。インク51が導電性を呈する場合、圧電素子22の一方の電極41と他の一方の電極42間や制御基板13にインク51が付着して、電氣的にショートしてしまうからである。また、金属薄板6をフィルム等の樹脂で代替することもできる。圧電素子22を金属薄板6に直接接合すれば構成としては簡素になるが、以下の理由によりこれができない。一つの理由として、図2に示すように、電極41が金属薄板6と接触すると隣接する圧電素子が短絡

してしまう。仮に、電極41側を共通電極とした場合には、インク51に電界が加わることになる。このことは、インク51が経時的にイオン化して、信頼性の劣化を招くことにつながる。そこで、中間部材10に絶縁部材即ち感光性樹脂を配することにより上記の問題から解放され、圧電素子22を制御するための配線の自由度が増すことになる。もう一つの理由は、図5に示すように、圧電素子22の断面形状とインク室5の断面形状が、コスト面及び製造上の理由から異なることにある。このことは、圧電素子22がインク室5を加減圧する際、図5に示すように、変位できる弾性部材8の長さ(イ)が短すぎて充分にたわむことができず、逆に変位できる弾性部材8の長さ(ロ)は長すぎて発生する圧力を吸収してしまう。よって、圧電素子22の変位を効率良くインク室5に圧力伝達するために、長さ(イ)(ロ)を適切に確保できる中間伝達部材が必要となる。上記理由から剛性を有する壁部材7aが必要とされる。従って、壁部材7aは、図5に示すようにたわみ量が確保できるように、インク室5の投影面より一回り小さく設計されている。壁部材7aは、電鍍加工法によって図4に示す形が作られる。また、図7に示されるように、島状部である壁部材7aの端面は、圧電素子22の先端50と壁部材7aとの位置合わせのマージン増大のため中間部材10が形成され、これに圧電素子22の先端50が接合されている。

【0022】ここで、インク滴吐出動作を図2を用いて説明する。印字信号に応じて制御基板13からリードフレーム25、配線パターン24を通じて圧電素子22の一方の電極41と他の一方の電極42とに電界を印加する。電界を印加された圧電素子22は長手方向(同図上下方向)に収縮しようとする。この時、圧電素子22の下半分は、ヘッドフレーム11に保持される固定台21に固着されており、収縮変位できない。一方、圧電素子22の上半分は、他の拘束を受けることなく収縮変位して、その収縮力により中間部材10を介して弾性部材8を引張る。中間部材10を介して圧電素子22に引張られた弾性部材8の金属薄板6が下方へたわみ、その結果インク室5の体積が膨張する。インク室5が膨張すると、リザーバ4からインク供給口3cを通じてインク51が流入する。次いで、圧電素子22の電界を解除すると、圧電素子22は元の長さに伸長してインク室5を圧縮する。この圧力でノズル2からインク滴を吐出する。圧電素子22の変位をインク室5に伝える中間部材10と弾性部材8の壁部材7aは前述したように、インク室5の投影面より一回り小さいため、金属薄板6のたわみ部を残しつつインク室5をまんべんなく加圧及び減圧する。

【0023】ところで、本発明の中間部材10を形成しない従来の結合構造例では、複数のインク室5が密接し、一対一に脚部27を配設する。圧電素子22aと脚

部27は、発生力伝達時損失をなくするため当接後直接接合する。しかし、寸法が極端に小さな構造の位置合わせで、図6に示すごとく圧電素子22aが隣接する脚部27に端部が掛かり、隣接インク室5、5、5……間で干渉する恐れがある。また、接着剤が部分的に多量に塗布されることで振動部である弾性部材8aが軸受構成部材28と共に固化されてしまう危険性も高い。従って、この間隙には、圧電素子22aと弾性部材8aとを接合するために必要最小限の接着剤を塗布することが必要となる。接着方法としては、一般に一定量の接着剤を圧電素子22aまたは弾性部材8aに、各塗布部に塗布厚バラつきがでないように塗布した後、両者を当接した状態で保持し同接着剤を硬化させている。これ以外では、例えば、圧電素子22aと弾性部材8aとを当接後、圧電素子22aと弾性部材8aとの各間隙に応じた適度な量を充填することが考えられるが、構造上、製法上制約が大きく実現する可能性は極めて小さい。そこで、一定量の接着剤を管理しながら塗布する方法を採ることとなる。

【0024】圧電素子22aと弾性部材8aとの位置合わせが寸法が極端に小さな構造で困難である場合、接着剤の接合状態において図6の9a、9b、9c、……のごとく、バラつきの大きい状態が形成されることとなる。ここでは、代表的な3タイプを図示しているが、実際にはもっと多くの接合状態が生じている。9aは、圧電素子22aから弾性部材8aへの動圧伝達には問題無い接合状態を示し、接合としては安定して硬化している。これは、即ち弾性部材8aあるいは圧電素子22a上の接着剤が適量に保たれているからである。一方、9bは接合するべき脚部27の隣接する脚部27へ接合した状態を示す。この状態においては、目的外の不必要なインク室5からのインクの吐出が生ずることとなる。9cは接着剤塗布量の過剰であることと、ノズル基板1a、キャビティ形成基板3d、弾性部材8a、軸受構成部材28の製造過程により生ずる厚み方向のバラつきや反りにより脚部27と圧電素子22aとの間隙が狭くなることが起因して、軸受構成部材28をも接合している状態を示す。この状態はまた、脚部27と軸受構成部材28とは滑らかに動作しなければならない関係から、圧電素子22a変位方向において前記二部材は大きな断差を形成することができなく、従って壁部材7aならびに圧電素子22a上の接着剤Bを9cのように容易に取り込み易く、圧電素子22aの伸縮が阻止されることとなる。よって、接着剤Bの流出を防ぐために圧電素子22aの固着されない半分の先端50と脚部27の当接面との間隙を適切で均一な状態にすると共に、脚部27と軸受構成部材28と少なくとも接着剤の塗布高さh a程度に段差をつけることが重要である。

【0025】一方図7は、本発明で実施される中間部材10を設けたことによる効果を説明する部分断面図である。また、脚部27と軸受構成部材28間の摩擦に対し

対策を構じた構造を示している。同図において、後述する方法で中間部材10を形成し、圧電素子22aと接合された状態を示す。中間部材は同図のごとく、10d、10e、10f……で、前述したノズル基板1a、キャビティ形成基板3d、弾性部材8bの製造過程による厚み方向のバラつきやソリを補正し、9d、9e、9fで示すように、適度な間隙を形成している。また、後述する製造方法により中間部材10の高さと隣接壁部材8bとの段差を活かし接着状態を安定して形成している。その上、壁部材8b上へ接着剤Bを塗布した場合においても隣接する壁部材8b上の接着剤Bを圧電素子22aに引き込むことがなくなる。

【0026】その他前述の実施例以外にも、例えば図12のように、圧電素子22側に中間部材14を形成することもできる。また、図13のように、圧電素子22側に中間部材16を形成し、弾性部材8側に中間部材15を形成することもできる。

【0027】次に図8、図9に従って弾性部材8とキャビティ形成基板3とノズル基板1との接合体の製造方法について述べる。図8、図9は圧電素子22の複数並列方向から見た断面を示すものである。キャビティ形成基板3の製造法としてはプレス加工、電鍍成形、エッチング等の方法があるが、ここでは最も容易なる感光性樹脂フィルムを用いた製法で、ノズル基板1と弾性部材8の各々へキャビティ形成基板3を2部に分割して形成し、後に分割形成した2部を融着して仕上げる方法について説明する。最初に、図8を用いキャビティ形成基板3のノズル基板1側のキャビティ形成について説明する。前述のごとくプレス加工または電鍍加工法によって加工されたノズル基板1に感光性樹脂フィルム（以下ドライフィルムと呼ぶ）61をラミネートする。次に紫外線を露光するパターンと露光しないパターンを形成したガラスマスク62をドライフィルム61側に配し、紫外線を照射し露光を行う。露光後には、ドライフィルム61上に、露光によって硬化した部分と露光されない未露光部分が形成される。次に、現像を行うことによって未露光部分を除去し、キャビティ形成基板3aとノズル基板1の接合体70が完成する。

【0028】一方、図9のように弾性部材8側も前記キャビティ形成基板3aと同様にして電鍍加工法によって加工された弾性部材8上にキャビティ形成基板3bを形成することで接合体80が完成する。そして、キャビティの完成体は、キャビティ形成基板3aとノズル基板1との接合体70とキャビティ形成基板3bと弾性部材8との接合体80の両者を当接し、150～170℃の温度で融着することによって、キャビティ形成基板完成体90が製造される。この時、ドライフィルム表面は熱によって融着されるが、加圧力と時間によってドライフィルムのつぶれ量が決定される。また、加圧が均等に成されることがドライフィルムのつぶれ量のバラつきを少な

くする上で重要となる。そこで加圧均等を目的に、キャビティ形成基板3aとキャビティ形成基板3bとが当接する位置には、壁部材7bを配設してドライフィルムのつぶれ量のバラつきの安定化を図っている。そのため、隣接するインク室5、5、5……間に壁部材7bが配設され、壁部材7aとの間隔が密となり高密度配列が困難となる。よって、圧電素子22との接合時に中間部材10を設けることが重要になる。また、実際には、ドライフィルム上における融着肉の有無即ちパターン配列の方法によって、つぶれ量のアンバランスが起こり易い。また、融着時の加熱から常温への冷却過程では、ソリが発生しやすくなる。以上の理由から、製造時にキャビティ形成基板完成体90の厚みhのバラつきが発生しやすくなっている。従って、圧電素子22と弾性部材8との間隙バラつきにおいても中間部材10は重要な役割を果たすこととなる。

【0029】図10は、前記中間部材10を形成する過程を示す。90は、キャビティ形成基板完成体である。まず、キャビティ形成基板完成体90の弾性部材8側に、中間部材10を形成する流動性物質10aを塗布する。必要に応じて、塗布前に密着力向上を目的として、弾性部材8にプライマー処理を施すこともある。流動性物質10aは、感光性樹脂、熱硬化性樹脂、常温硬化性樹脂があげられるが、特にポリエステル樹脂、アクリル樹脂、エポキシ樹脂、APR樹脂、各種レジストが使用される。本実施例では、比較的簡単に扱えるコスト的にも安価なポリエステル樹脂（感光性樹脂）を用いている。次に、弾性部材8の最も凸となる部分から、一定の距離を離間せしめる、少なくとも後述の中間部材10上への転写接着剤高さha（図11）以上の、間隙部材（図示せず）を設けた部分に、離型性を目的としたPETフィルムを、少なくとも流動性物質10aよりも広い範囲に載置する。次に、前記フィルム上に平坦の基準となるガラスマスク91を載置する。このガラスマスク91には、流動性物質10aに対して露光部と未露光部を選択的に形成する目的で、パターンが配されている。更に、このガラスマスクの少なくともフィルム側の片面は、研磨加工で平面度0.1～0.2μm程度に仕上げられている。このガラスマスク91を載置した後、300～400nm程度の波長を持つ紫外線を照射することによって、露光を行う。流動性物質10aは、可視光線400nm以上には感光しにくいので、暗室や特別な設備は必要ない。前記露光後には、流動性物質10aは2分化され、被露光部は化学変化を起こして硬化し未露光部は流動性の状態を保っている。この状態で、未露光部で流動性の部分の除去を行う。流動性物質10aは、弱アルカリ液あるいは水で簡単に除去できるので、作業は安全且つ無害である。また、硬化部分を更に確実に硬化させる目的で、後露光を必要に応じて実施することもできる。その上、未露光部除去時に膨潤した成分の乾燥を目的に

60～80℃の温度を加えることもある。以上の方法により、中間部材10を形成することができ、平面精度については前記ガラスマスク91と同程度な高精度の中間部材10を形成することができる。尚、本実施例以外でも、前記熱硬化性樹脂や常温硬化性樹脂についても、同様に高精度な中間部材10を形成することができる。

【0030】次に図11に従って高密度に配設したキャビティ形成基板完成体90上に形成された中間部材10と圧電素子22とを、接着塗布量を安定して容易に得ることのできる製造方法について説明する。前記製造方法により形成した弾性部材8の壁部材7a上の中間部材10の平面精度は、前記の通りガラスマスクの平面度程度には仕上げられている。しかし、圧電素子22aの固定台と固着されない半分の先端50と当接することで前記中間部材10との間隙バラつきが1～3μm程度はある。これまでに間隙バラつきは最小限に収められている。そこで、残留バラつきは接着剤Bの高さhaで吸収しなければならない。従って、少なくとも4μmから、多くても金属薄板6へはみ出さない程度で、接着剤Bの高さhaを中間部材10上に均一に塗布しなければならない。接着剤B一定量塗布の方法としては、スピンコート、スプレー印刷、タコ印刷、平板転写、スクリーン印刷があるが、本構造では金属薄板6へのはみ出しが厳禁であるためスピンコート、スプレー印刷、スクリーン印刷は使用できない。また、金属薄板6が5μm以下と非常に薄く、タコ印刷では圧力が加わるため金属薄板6の破壊を導き使用できない。平板転写については、一般的に片面が高精度な平面精度を有する平板を用い被転写物へ転写するが、本構造では少量の接着剤Bを微量ではあるが平面度バラつきをもつ中間部材10へと転写しなければならない。その上圧力を加えられないことを考慮すると、平板転写は一定量塗布にとって不適切な方法となる。そこで、本発明の構造に対しては転写印刷法の一つであるフィルム転写により、フィルムが平面度のバラつきに追従する特徴を活かし高精度に転写高さhaを管理した塗布を行なう。

【0031】製造方法は、図11に示すように片面を0.1～0.2μm程度に仕上げたある平板へ、本実施例ではポリイミドの5μm～20μmのフィルムを密接し、上部に接着剤Bのフィルム上での高さを管理し、転写に必要な面積を制限するスペーサー65を設置する。このスペーサーの塗布範囲内に接着剤Bを滴下し、余分な接着剤Bを端部が線状に平坦性を有するかき取り板で排除する。この一連の工程を迅速に行うことで、スペーサー厚と同程度の接着剤B高さを得る。そして、スペーサーを排除した後、接着剤Bの塗布されているフィルムを中間部材10上へ接着剤Bの表面張力を利用して置く。接着剤Bの塗布されているフィルムは柔軟であるためキャビティ形成基板完成体90の表面形状に追従して接着剤Bの粘性により引き寄せられる。この時、接着剤

B塗布部に気泡が混入しないように徐々にフィルムを中間部材10及び壁部材7b上へと置いていく。接着剤Bの当接した部分は、このフィルムを除去すると、均一高さhaに転写された接着剤Bを得る。フィルム転写は、被転写物の平面度に拘らず被転写物の形状に追従するため、接着剤Bの転写量はいずれの転写部分においても均一に転写される。本被転写物は、表面が矩形の連続であり、中間部材10が高所となっているため接着剤Bがその側面に少量塗布される。従って接合時の接着剤メニスカス形状が中間部材10の側面まで至り接合高強度を得ることができる。フィルム転写の特徴は、フィルムの剛性やフィルムの種類を被転写物の表面形状に合わせ選択し、接着剤の主成分、粘度を被転写物の表面積、表面状態に適したものを選択することで、様々な複雑なる表面形状、表面粗さの部品の接着剤塗布が塗布厚均一に容易に行える。以上のように容易なる方法で得られた中間部材10上の均一高さhaの接着剤Bに、図7のように圧電素子22aの固定台と固着されない半分の先端50と当接することで、圧電素子22aは壁部材7bと接合することなく、また金属薄板6へ接着剤が流出することなく安定して壁部材7aと接合することができる。

【0032】以上述べたごとく形成した圧電素子22と弾性部材8との結合構造は、圧電素子22の発生力を損失無くインク室5へ伝達できるものである。特徴としては、個々のインク吐出装置において、圧電素子22と弾性部材8間の結合構造は他からの拘束を全く受けないことにある。また中間部材10が樹脂であり軽いこと、その上接着剤塗布量が安定し中間部材10を設けていることにより位置合わせにマージンが広く取れ、容易に的確に当接するべく圧電素子22と弾性部材8とを接合できる。

【0033】

【発明の効果】以上説明したように、並列に密接して配設されるインク吐出装置の圧電素子と壁部材間の結合構造で、接着剤流出による他との剛体化を防ぐことが出来、インク吐出装置の高密度配列を可能にする。また、各部材間を強固に接合により結合させるため高速応答性を実現できる。更に、中間部材が隣接部材との断差を管理して形成できるため、隣接壁部材との接合を防ぐことができ、平面方向で圧電素子の弾性部材に対する位置合わせのマージンを広くとることができ、圧電素子はその変位方向の横断方向に結合による負荷が加わらないため信頼性が得られる。その結果、圧電素子の変位を忠実且つ効率良くインク室に伝えることができるようになり、高速応答性を有するインク吐出特性の安定した高密度ヘッドを得ることができる。

【図面の簡単な説明】

【図1】本発明の1実施例の構成を示す斜視図である。

【図2】同上実施例の部分断面図である。

【図3】同上実施例の90度回転した面の部分断面図で

ある。

【図4】同上実施例を下方より見た部分斜視図である。

【図5】同上実施例を真上より見た平面図である。

【図6】従来例の問題を説明する部分断面図である。

【図7】本発明の効果を説明する部分断面図である。

【図8】本発明の1実施例の1製法を示す図である。

【図9】同上実施例の1製法を示す図である。

【図10】同上実施例の1製法を示す図である。

【図11】本発明の製造方法を説明する部分断面図である。

【図12】本発明の他の実施例の部分断面図である。

【図13】本発明の他の実施例の部分断面図である。

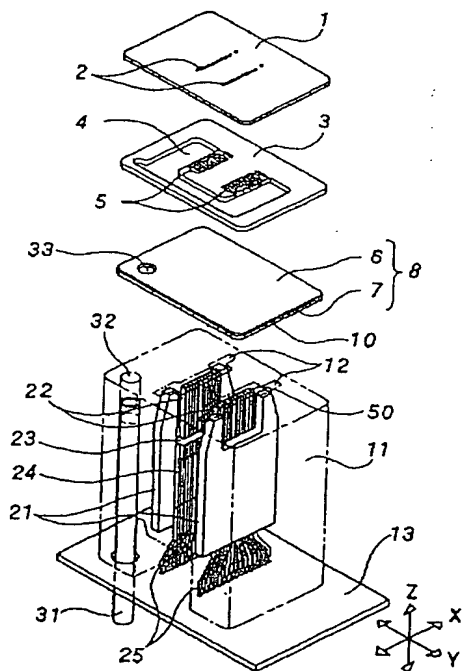
【符号の説明】

- 1、1a ノズル基板
 3、3d キャビティ形成基板
 5 インク室
 6 金属薄板
 7、7a、7b 壁部材
 8、8a 弾性部材
 9a、9b、9c、9d、9e、9f 接着剤の流動硬化状態
 10、10d、10e、10f、14、15、16 中*

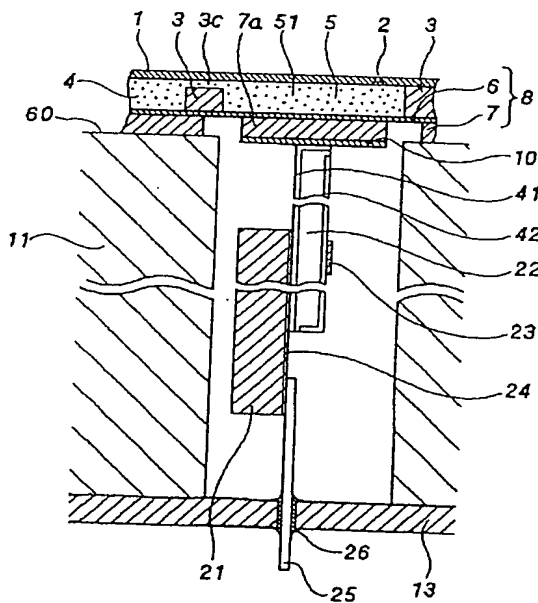
* 間部材

- 10a 流動性物質
 11 ヘッドフレーム
 12 取り付け穴
 21 固定台
 22、22a 圧電素子
 23 共通板
 24 配線パターン
 25 リードフレーム
 10 27 脚部
 28 軸受構成部材
 31 インク供給管
 32 インク接続口
 33 インク連絡口
 51 インク
 60 ヘッドフレーム平面
 61 感光性樹脂フィルム（ドライフィルム）
 62 ガラスマスク
 90 キャビティ形成基板完成体
 91 ガラスマスク（基準平板）

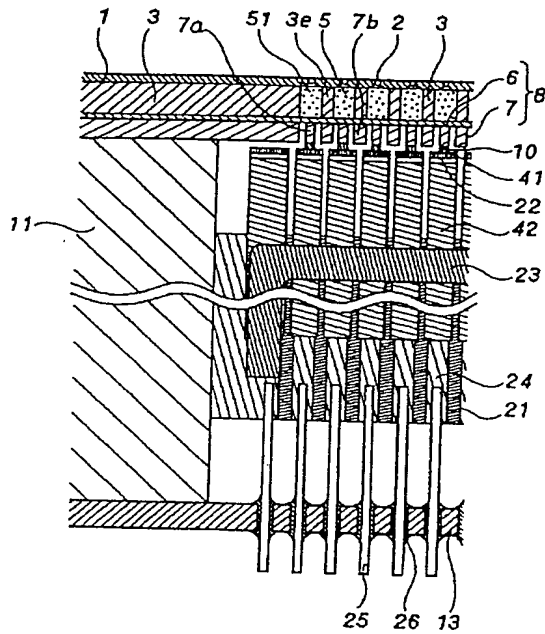
【図1】



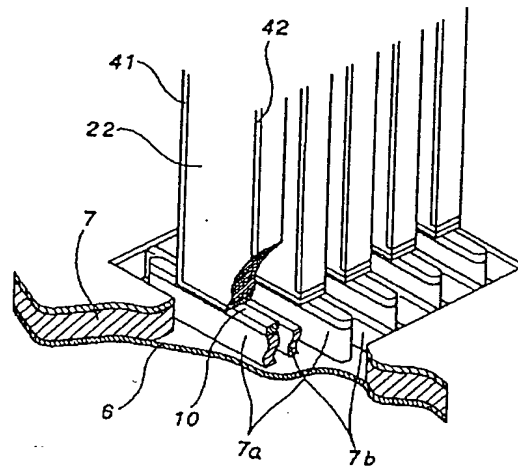
【図2】



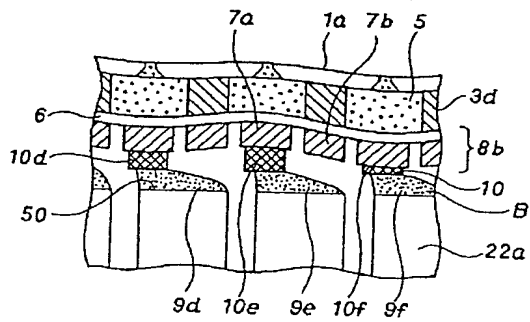
【図3】



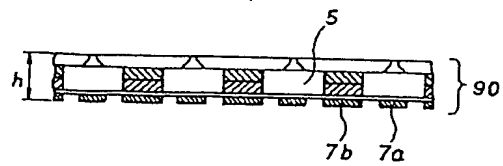
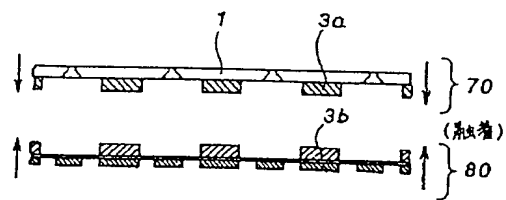
【図4】



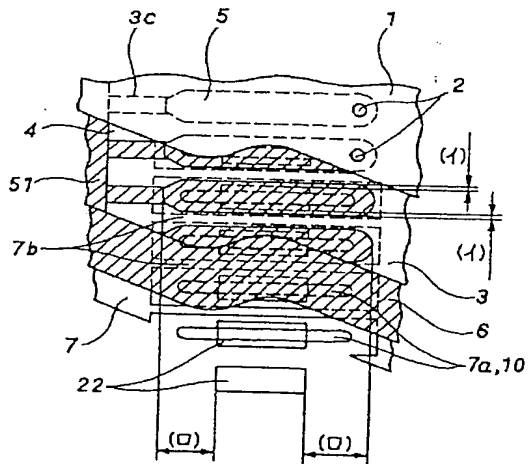
【図6】



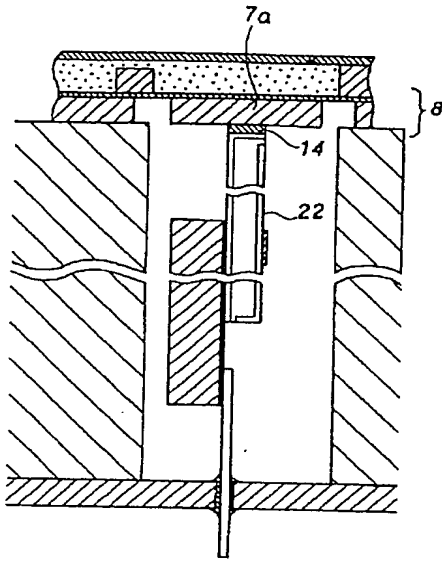
【図10】



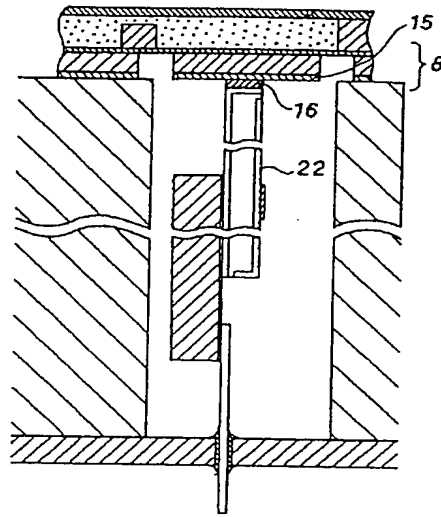
【図5】



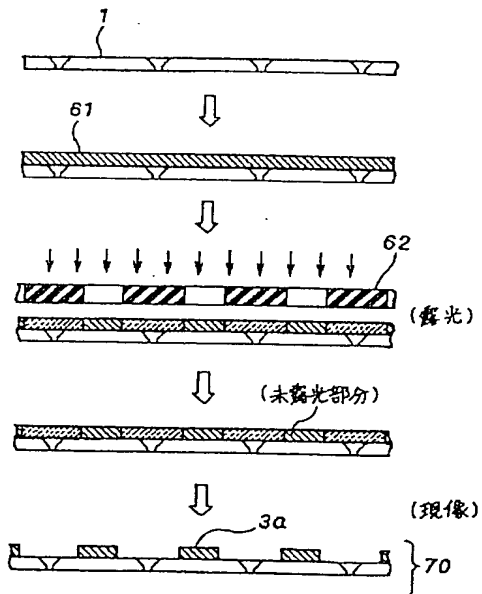
【図7】



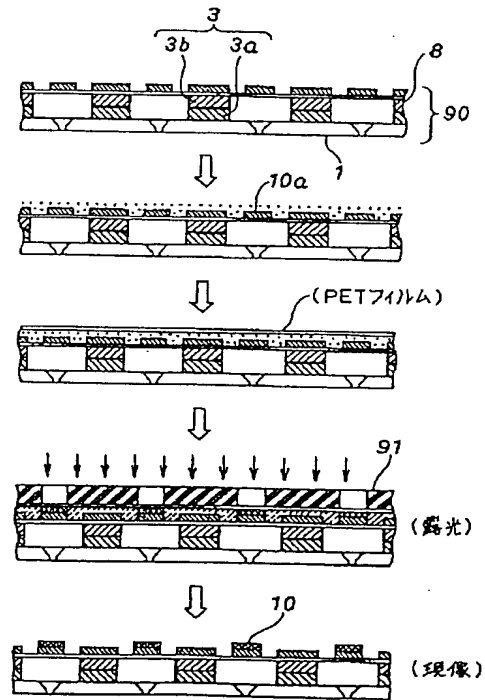
【図8】



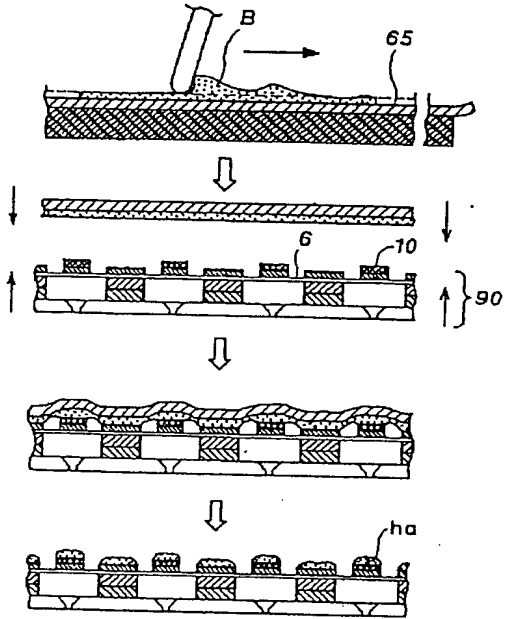
【図9】



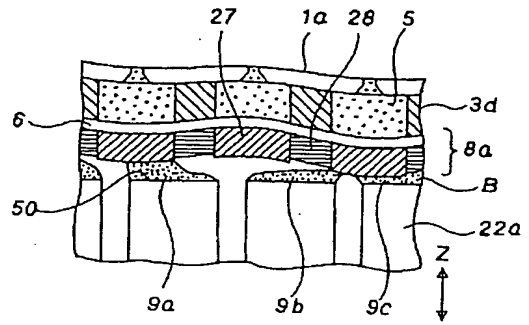
【図11】



【図12】



【図13】



【公報種別】特許法第17条の2の規定による補正の掲載
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 103 H

【手続補正書】

【提出日】平成11年6月1日(1999. 6. 1)

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】全文

【補正方法】変更

【補正内容】

【書類名】明細書

【発明の名称】 インクジェット式印字ヘッド及びその製造方法

【特許請求の範囲】

【請求項1】 ノズルと、該ノズルと連通するインク室と、該インク室の一部を形成する弾性部材と、該弾性部材と結合する圧電素子とを備え、前記弾性部材を前記圧電素子によって変位させてインク室内のインク圧力を高め、前記ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、前記弾性部材と前記圧電素子が当接する部分に前記弾性部材と前記圧電素子の距離のバラツキを、前記当接する部分毎に補正する中間部材を設けたことを特徴とするインクジェット式印字ヘッド。

【請求項2】 前記圧電素子の並び方向における前記中間部材の幅は、前記弾性部材及び前記圧電素子の幅より狭く、接着により固定されていることを特徴とする請求項1記載のインクジェット式記録ヘッド。

【請求項3】 請求項1または請求項2記載のインクジェット式印字ヘッドの製造方法において、接着剤を薄膜状に塗布し、前記接着剤の薄層を、接合固定される前記弾性部材あるいは前記圧電素子あるいは形成された前記中間部材に転写し、前記弾性部材と前記圧電素子とを押圧、固定することを特徴とするインクジェット式印字ヘッドの製造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、印字信号に応じてインク滴を吐出して、記録紙等の記録媒体上にインク像を形成するオンデマンド型インクジェット式プリンタの記録ヘッド及びその製造方法に関する。

【0002】

【従来の技術】印字信号に応じてインク滴を飛翔させる、いわゆるオンデマンド型インクジェット式プリンタの記録ヘッドは、日本特許公報特公平2-45985号や特公平2-52625号に示されたように、一端が基台に固定された圧電素子の他端を、インク室を形成する容器の弾性壁に、脚部を介して当接させて構成される。この脚部は弾性壁を構成する部材に隣接する部材内の円柱形開口の軸受手段に沿った並進運動をしている。同公報の技術によると、圧電素子を収縮させてインク室体積を増大し、再び圧電素子を伸長させることでインク室体積を減少させインクをノズルから液滴として吐出している。更に同技術の構成は、脚部を軸受手段に線接触させて支持させる構造をとっている。

【0003】

【発明が解決しようとする課題】記録ヘッドの小型化、高密度化を図るほど圧電素子やインク室の寸法は小さくなる。前出の公報の構成では、脚部部材や脚部挿入軸受構成部材等、複雑なる形状の部材を積層する構造であり、小型化した各部材の寸法を高精度に管理し製造することが非常に困難である。つまり圧電素子からの発生力を伝達する脚部と脚部挿入軸受構成部材との接触状態を複数のインク吐出装置において必要精度を得ることが困難であるという問題点を有する。

【0004】また、圧電素子からの発生力の伝達が、インク吐出装置の相互間で、複数の脚部を同一の脚部挿入軸受構成部材内で並進運動させるために干渉するという問題点を有する。

【0005】更に、圧電素子と脚部の結合手段で、圧電

素子の圧電素子長軸に横断方向の側方運動を阻止する脚部構造への圧電素子の位置合わせまたは係合手段を圧電素子と脚部に配設した場合の位置合わせは、寸法の小さくなった、剛性の低下した圧電素子を定位置へ組み込ませることとなり、圧電素子への前記横断方向への負荷が加わり、圧電素子の信頼性を損なうという問題点を有する。

【0006】その上、脚部と弾性壁間に機械的結合手段を用いているため結合部の剛性が低く、インク吐出の高速応答性が得られないという問題点を有する。

【0007】そこで、本発明の全体的な目的は、圧電変換器と弾性壁との間の改良された結合構造を提供することにある。

【0008】本発明の他の目的は安価な結合方法を提供することにある。

【0009】本発明の他の目的は容易に量産できる結合構造かつ結合製造方法を提供することにある。

【0010】本発明の他の目的は圧電素子発生力損失の少ない、複数のインク吐出装置で均一なる性能の発揮できる結合方法を提供することにある。

【0011】本発明の他の目的はインク吐出装置の相互間の干渉を防ぐ結合構造を提供することにある。

【0012】本発明の他の目的は信頼性を有する結合方法を提供することにある。

【0013】本発明の他の目的はインク吐出の高速応答性の有する結合方法を提供することにある。

【0014】

【課題を解決するための手段】本発明のインクジェット式印字ヘッドは、ノズルと、該ノズルと連通するインク室と、該インク室の一部を形成する弾性部材と、該弾性部材と結合する圧電素子とを備え、弾性部材を圧電素子によって変位させてインク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、弾性部材と圧電素子が当接する部分に弾性部材と圧電素子の距離のバラツキを、当接する部分毎に補正する中間部材を設けたことを特徴とする。

【0015】また、係るインクジェット式印字ヘッドにおいて、圧電素子の並び方向における中間部材の幅は、弾性部材及び圧電素子の幅より狭く、接着により固定されていることを特徴とする。

【0016】また、係るインクジェット式印字ヘッドの製造方法において、接着剤を薄膜状に塗布し、接着剤の薄層を、接合固定される弾性部材あるいは圧電素子あるいは形成された中間部材に転写し、弾性部材と圧電素子とを押し、固定することを特徴とする。

【0017】

【実施例】図1は本発明の一実施例の構成を示す斜視図であり、組立後に各部品を分解したものである。図2、図3、図4、図5はそれぞれ、同実施例をより詳細に描いた部分断面図、同実施例の前記部分断面図を90度回

転した部分断面図、同実施例を下方より見た部分斜視図、同実施例を真上より見た部分平面図を示す。尚、図5は構成部品を上より順次透過した状態を示す。図13は従来の問題点を説明する部分断面図、図6は本発明の構造での効果を説明する部分断面図を示す。図9、図10はインク室の製造方法の一実施例を説明するための部分断面図を示す。図11は本発明の実施例の構成に基づいて、中間部材を形成する製造方法を説明するための部分断面図を示す。図12は本発明の実施例に基づいて、本発明の製造方法を説明するための部分断面図を示す。図7、図8は本発明の他の実施例を説明するための部分断面図を示す。

【0018】これらの図において、1はノズル基板である。ノズル基板1には、複数のノズル2を設けてある。3はキャビティ形成基板である。キャビティ形成基板3は、ノズル基板1と、弾性壁となる弾性部材8とで挟まれて、リザーバ4とインク室5を形成する。弾性部材8は、金属薄板6と壁部材7とからなる積層構造を成す。弾性部材8、キャビティ形成基板3、ノズル基板1は順次密着接合されキャビティを形成した後、後述する中間部材10を弾性部材8側に形成し、ヘッドフレーム11上に密着接合されている。

【0019】図1をもとに本発明を説明する。インク滴吐出の駆動源となる圧電素子22は、その長手方向の約半分の一面を固定台21に固着され、固着されない半分の先端50を中間部材10と接合している。固定台21には正極と負極の導通配線パターン24が施され、リードフレーム25を介して、制御基板13により制御された電界を圧電素子22に与える。11はヘッドフレームである。12はヘッドフレーム11内を貫通する取り付け穴で、圧電素子22のX、Y方向の位置合わせ(図1のXYZ座標参照)をするべく固定台21を支持する。尚、圧電素子22のZ方向は、中間部材10と弾性部材8とキャビティ形成基板3とノズル基板1を接合した接合体を、ヘッドフレーム11に接合後、圧電素子22の先端50を中間部材10に当接して位置合わせする。

【0020】31はインク溜部(図示せず)からインク51を供給するインク供給管である。インク供給管31は、ヘッドフレーム11に圧入接合されている。インク流路は、ヘッドフレーム11にあるインク接続口32と弾性部材8にあるインク連絡口33を経て、キャビティ形成基板3のリザーバ4、更にインク室5と連通している。以上が概略構成である。

【0021】図2、図3に従って、構造について更に詳しく述べる。図2は複数並列(図1のX方向)する圧電素子22の、一本の圧電素子を図1のY方向へ中央より切断したときの部分断面図である。弾性部材8の圧電素子22が中間部材10を介して当接する壁部材7aは、圧電素子22の当接部断面積よりインク室断面積が大きいために、インク室5の弾性壁の変位量を可能な限り大

面積で均一に得るため、金属薄板6に対して剛性の補強を図っている。圧電素子22は、一方の電極41と他の一方の電極42が対向している。電極41は、固定台21上の配線パターン24に接合と同時に電気接続されている。他の電極42は、共通板23により、固定台21上の配線パターン24、特に電極41に反する電極と電気接続している。配線パターン24と制御基板13とをリードフレーム25で結び、それぞれ接続箇所を半田26で固着している。尚、固定台21は、圧電素子22が中間部材10に当接した状態で、ヘッドフレーム11に接合固定されている。つまり、圧電素子22のZ方向は中間部材10で位置合わせする。壁部材7と当接するヘッドフレーム11の平面60は、平面研磨等の手段により高精度に仕上げられている。

【0022】図3は複数並列する圧電素子22の図1のX方向へ中央より切断したときの部分断面図である。ノズル基板1とキャビティ形成基板3と弾性部材8とは密着接合した積層構造であり、密着接合させるために、弾性部材8の壁部材7はノズル基板1と弾性部材8とに当接する。インク室間を隔てる壁3eに接合圧力を加えることが必要であり、圧電素子22からの発生力を伝達する壁部材7aとは別に壁部材7bを配設する。

【0023】一方、図5のごとくインク51が充填されるインク室5及びリザーバ4は、キャビティ形成基板3とノズル基板1と弾性部材8とで形成される。キャビティ形成基板3は、ガラスのエッチング加工、金属薄板の積層、感光性樹脂の露光形成、樹脂の射出成形等で作ることができるが、本実施例では、コスト的に安価な感光性樹脂を用いている。キャビティ形成基板3の上面を覆うノズル基板1は、プレス加工によって、複数のインク室5にそれぞれ一つずつノズル2が開けられた、0.1mm程のステンレス鋼板からなる。ノズル基板1は、ニッケルの電鍍加工法によっても作ることができる。また、キャビティ形成基板3の下面を覆う弾性部材8は、ニッケルの電鍍加工法で5 μ m以下の厚さに形成した金属薄板6に、同加工法で10～100 μ m程度の厚さに形成した壁部材7を積層した構造をなす。壁部材7は、レジストを塗布することで容易に必要な形状を得ることが出来る。金属薄板6は、圧電素子22の伸縮をインク室5に効率良く伝えるために薄いほど好ましいが、インク室5内のインク51がしみ出してはならない。インク51が導電性を呈する場合、圧電素子22の一方の電極41と他の一方の電極42間や制御基板13にインク51が付着して、電氣的にショートしてしまうからである。また、金属薄板6をフィルム等の樹脂で代替することもできる。圧電素子22を金属薄板6に直接接合すれば構成としては簡素になるが、以下の理由によりこれができない。一つの理由として、図2に示すように、電極41が金属薄板6と接触すると隣接する圧電素子が短絡してしまう。仮に、電極41側を共通電極とした場合に

は、インク51に電界が加わることになる。このことは、インク51が経時的にイオン化して、信頼性の劣化を招くことにつながる。そこで、中間部材10に絶縁部材即ち感光性樹脂を配することにより上記の問題から解放され、圧電素子22を制御するための配線の自由度が増すことになる。もう一つの理由は、図5に示すように、圧電素子22の断面形状とインク室5の断面形状が、コスト面及び製造上の理由から異なることにある。このことは、圧電素子22がインク室5を加減圧する際、図5に示すように、変位できる弾性部材8の長さ(イ)が短すぎて十分にたわむことができず、逆に変位できる弾性部材8の長さ(ロ)は長すぎて発生する圧力を吸収してしまう。よって、圧電素子22の変位を効率良くインク室5に圧力伝達するために、長さ(イ)

(ロ)を適切に確保できる中間伝達部材が必要となる。上記理由から剛性を有する壁部材7aが必要とされる。従って、壁部材7aは、図5に示すようにたわみ量が確保できるように、インク室5の投影面より一回り小さく設計されている。壁部材7aは、電鍍加工法によって図4に示す形が作られる。また、図6に示されるように、島状部である壁部材7aの端面は、圧電素子22の先端50と壁部材7aとの位置合わせのマージン増大のため中間部材10が形成され、これに圧電素子22の先端50が接合されている。

【0024】ここで、インク滴吐出動作を図2を用いて説明する。印字信号に応じて制御基板13からリードフレーム25、配線パターン24を通じて圧電素子22の一方の電極41と他の一方の電極42とに電界を印加する。電界を印加された圧電素子22は長手方向(同図上下方向)に収縮しようとする。この時、圧電素子22の下半分は、ヘッドフレーム11に保持される固定台21に固着されており、収縮変位できない。一方、圧電素子22の上半分は、他の拘束を受けることなく収縮変位して、その収縮力により中間部材10を介して弾性部材8を引張る。中間部材10を介して圧電素子22に引張られた弾性部材8の金属薄板6が下方へたわみ、その結果インク室5の体積が膨張する。インク室5が膨張すると、リザーバ4からインク供給口3cを通じてインク51が流入する。次いで、圧電素子22の電界を解除すると、圧電素子22は元の長さに伸長してインク室5を圧縮する。この圧力でノズル2からインク滴を吐出する。圧電素子22の変位をインク室5に伝える中間部材10と弾性部材8の壁部材7aは前述したように、インク室5の投影面より一回り小さいため、金属薄板6のたわみ部を残しつつインク室5をまんべんなく加圧及び減圧する。

【0025】ところで、本発明の中間部材10を形成しない従来の結合構造例では、複数のインク室5が密接し、一対一に脚部27を配設する。圧電素子22aと脚部27は、発生力伝達時損失をなくするため当接後直接接

合する。しかし、寸法が極端に小さな構造の位置合わせで、図13に示すごとく圧電素子22aが隣接する脚部27に端部が掛かり、隣接インク室5、5、5……間で干渉する恐れがある。また、接着剤が部分的に多量に塗布されることで振動部である弾性部材8aが軸受構成部材28と共に固化されてしまう危険性も高い。従って、この間隙には、圧電素子22aと弾性部材8aとを接合するために必要最小限の接着剤を塗布することが必要となる。接着方法としては、一般に一定量の接着剤を圧電素子22aまたは弾性部材8aに、各塗布部に塗布厚バラつきがでないように塗布した後、両者を当接した状態で保持し同接着剤を硬化させている。これ以外では、例えば、圧電素子22aと弾性部材8aとを当接後、圧電素子22aと弾性部材8aとの各間隙に応じた適度な量を充填することが考えられるが、構造上、製法上制約が大きく実現する可能性は極めて小さい。そこで、一定量の接着剤を管理しながら塗布する方法を採ることとなる。

【0026】圧電素子22aと弾性部材8aとの位置合わせが寸法が極端に小さな構造で困難である場合、接着剤の接合状態において図13の9a、9b、9c、……のごとく、バラつきの大きい状態が形成されることとなる。ここでは、代表的な3タイプを図示しているが、実際にはもっと多くの接合状態が生じている。9aは、圧電素子22aから弾性部材8aへの動圧伝達には問題無い接合状態を示し、接合としては安定して硬化している。これは、即ち弾性部材8aあるいは圧電素子22a上の接着剤が適量に保たれているからである。一方、9bは接合するべき脚部27の隣接する脚部27へ接合した状態を示す。この状態においては、目的外の不必要なインク室5からのインクの吐出が生ずることとなる。9cは接着剤塗布量の過剰であることと、ノズル基板1a、キャビティ形成基板3d、弾性部材8a、軸受構成部材28の製造過程により生ずる厚み方向のバラつきや反りにより脚部27と圧電素子22aとの間隙が狭くなることが起因して、軸受構成部材28をも接合している状態を示す。この状態はまた、脚部27と軸受構成部材28とは滑らかに動作しなければならない関係から、圧電素子22a変位方向において前記二部材は大きな断差を形成することができなく、従って壁部材7aならびに圧電素子22a上の接着剤Bを9cのように容易に取り込み易く、圧電素子22aの伸縮が阻止されることとなる。よって、接着剤Bの流出を防ぐために圧電素子22aの固着されない半分の先端50と脚部27の当接面との間隙を適切で均一な状態にすると共に、脚部27と軸受構成部材28と少なくとも接着剤の塗布高さh a程度に段差をつけることが重要である。

【0027】一方図6は、本発明で実施される中間部材10を設けたことによる効果を説明する部分断面図である。また、脚部27と軸受構成部材28間の摩擦に対し

対策を構じた構造を示している。同図において、後述する方法で中間部材10を形成し、圧電素子22aと接合された状態を示す。中間部材は同図のごとく、10d、10e、10f……で、前述したノズル基板1a、キャビティ形成基板3d、弾性部材8bの製造過程による厚み方向のバラつきやソリを補正し、9d、9e、9fで示すように、適度な間隙を形成している。また、後述する製造方法により中間部材10の高さと隣接壁部材8bとの段差を活かし接着状態を安定して形成している。その上、壁部材8b上へ接着剤Bを塗布した場合においても隣接する壁部材8b上の接着剤Bを圧電素子22aに引き込むことがなくなる。

【0028】その他前述の実施例以外にも、例えば図7のように、圧電素子22側に中間部材14を形成することもできる。また、図8のように、圧電素子22側に中間部材16を形成し、弾性部材8側に中間部材15を形成することもできる。

【0029】次に図9、図10に従って弾性部材8とキャビティ形成基板3とノズル基板1との接合体の製造方法について述べる。図9、図10は圧電素子22の複数並列方向から見た断面を示すものである。キャビティ形成基板3の製造法としてはプレス加工、電鋳成形、エッチング等の方法があるが、ここでは最も容易なる感光性樹脂フィルムを用いた製法で、ノズル基板1と弾性部材8の各々へキャビティ形成基板3を2部に分割して形成し、後に分割形成した2部を融着して仕上げる方法について説明する。最初に、図9を用いキャビティ形成基板3のノズル基板1側のキャビティ形成について説明する。前述のごとくプレス加工または電鋳加工法によって加工されたノズル基板1に感光性樹脂フィルム（以下ドライフィルムと呼ぶ）61をラミネートする。次に紫外線を露光するパターンと露光しないパターンを形成したガラスマスク62をドライフィルム61側に配し、紫外線を照射し露光を行う。露光後は、ドライフィルム61上に、露光によって硬化した部分と露光されない未露光部分が形成される。次に、現像を行うことによって未露光部分を除去し、キャビティ形成基板3aとノズル基板1の接合体70が完成する。

【0030】一方、図10のように弾性部材8側も前記キャビティ形成基板3aと同様にして電鋳加工法によって加工された弾性部材8上にキャビティ形成基板3bを形成することで接合体80が完成する。そして、キャビティの完成体は、キャビティ形成基板3aとノズル基板1との接合体70とキャビティ形成基板3bと弾性部材8との接合体80の両者を当接し、150～170℃の温度で融着することによって、キャビティ形成基板完成体90が製造される。この時、ドライフィルム表面は熱によって融着されるが、加圧力と時間によってドライフィルムのつぶれ量が決定される。また、加圧が均等に成されることがドライフィルムのつぶれ量のバラつきを少

なくする上で重要となる。そこで加圧均等を目的に、キャビティ形成基板3aとキャビティ形成基板3bとが当接する位置には、壁部材7bを配設してドライフィルムをつぶれ量のバラつきの安定化を図っている。そのため、隣接するインク室5、5、5……間に壁部材7bが配設され、壁部材7aとの間隔が密となり高密度配列が困難となる。よって、圧電素子22との接合時に中間部材10を設けることが重要になる。また、実際には、ドライフィルム上における融着肉の有無即ちパターン配し方によって、つぶれ量のアンバランスが起り易い。また、融着時の加熱から常温への冷却過程では、ソリが発生しやすくなる。以上の理由から、製造時にキャビティ形成基板完成体90の厚みhのバラつきが発生しやすくなっている。従って、圧電素子22と弾性部材8との間隙バラつきにおいても中間部材10は重要な役割を果たすこととなる。

【0031】図11は、前記中間部材10を形成する過程を示す。90は、キャビティ形成基板完成体である。まず、キャビティ形成基板完成体90の弾性部材8側に、中間部材10を形成する流動性物質10aを塗布する。必要に応じて、塗布前に密着力向上を目的として、弾性部材8にプライマー処理を施すこともある。流動性物質10aは、感光性樹脂、熱硬化性樹脂、常温硬化性樹脂があげられるが、特にポリエステル樹脂、アクリル樹脂、エポキシ樹脂、APR樹脂、各種レジストが使用される。本実施例では、比較的簡単に扱えコスト的にも安価なポリエステル樹脂（感光性樹脂）を用いている。次に、弾性部材8の最も凸となる部分から、一定の距離を離間せしめる、少なくとも後述の中間部材10上への転写接着剤高さha（図12）以上の、間隙部材（図示せず）を設けた部分に、離型性を目的としたPETフィルムを、少なくとも流動性物質10aよりも広い範囲に載置する。次に、前記フィルム上に平坦の基準となるガラスマスク91を載置する。

【0032】このガラスマスク91には、流動性物質10aに対して露光部と未露光部を選択的に形成する目的で、パターンが配されている。更に、このガラスマスクの少なくともフィルム側の片面は、研磨加工で平面度0.1~0.2μm程度に仕上げられている。このガラスマスク91を載置した後、300~400nm程度の波長を持つ紫外線を照射することによって、露光を行う。流動性物質10aは、可視光線400nm以上には感光しにくいので、暗室や特別な設備は必要ない。前記露光後には、流動性物質10aは2分化され、被露光部は化学変化を起して硬化し未露光部は流動性の状態を保っている。この状態で、未露光部で流動性の部分の除去を行う。流動性物質10aは、弱アルカリ液あるいは水で簡単に除去できるので、作業は安全且つ無害である。また、硬化部分を更に確実に硬化させる目的で、後露光を必要に応じて実施することもできる。その上、未露光部

除去時に膨潤した成分の乾燥を目的に60~80℃の温度を加えることもある。以上の方法により、中間部材10を形成することができ、平面精度については前記ガラスマスク91と同程度な高精度の中間部材10を形成することができる。尚、本実施例以外でも、前記熱硬化性樹脂や常温硬化性樹脂についても、同様に高精度な中間部材10を形成することができる。

【0033】次に図12に従って高密度に配設したキャビティ形成基板完成体90上に形成された中間部材10と圧電素子22とを、接着塗布量を安定して容易に得ることのできる製造方法について説明する。前記製造方法により形成した弾性部材8の壁部材7a上の中間部材10の平面精度は、前記の通りガラスマスクの平面度程度には仕上げられている。しかし、圧電素子22aの固定台と固着されない半分の先端50と当接することで前記中間部材10との間隙バラつきが1~3μm程度はある。これまでに間隙バラつきは最小限に収められている。そこで、残留バラつきは接着剤Bの高さhaで吸収しなければならない。従って、少なくとも4μmから、多くても金属薄板6へはみ出さない程度で、接着剤Bの高さhaを中間部材10上に均一に塗布しなければならない。接着剤B一定量塗布の方法としては、スピンコート、スプレー印刷、タコ印刷、平板転写、スクリーン印刷があるが、本構造では金属薄板6へのはみ出しが厳禁であるためスピンコート、スプレー印刷、スクリーン印刷は使用できない。また、金属薄板6が5μm以下と非常に薄く、タコ印刷では圧力が加わるため金属薄板6の破壊を導き使用できない。平板転写については、一般的に片面が高精度な平面精度を有する平板を用い被転写物へ転写するが、本構造では少量の接着剤Bを微量ではあるが平面度バラつきをもつ中間部材10へと転写しなければならない、その上圧力を加えられないことを考慮すると、平板転写は一定量塗布にとって不適切な方法となる。そこで、本発明の構造に対しては転写印刷法の一つであるフィルム転写により、フィルムが平面度のバラつきに追従する特徴を活かし高精度に転写高さhaを管理した塗布を行なう。

【0034】製造方法は、図12に示すように片面を0.1~0.2μm程度に仕上げたある平板へ、本実施例ではポリイミドの5μm~20μmのフィルムを密接し、上部に接着剤Bのフィルム上での高さを管理し、転写に必要な面積を制限するスペーサー65を設置する。このスペーサーの塗布範囲内に接着剤Bを滴下し、余分な接着剤Bを端部が線状に平坦性を有するかき取り板で排除する。この一連の工程を迅速に行うことで、スペーサー厚と同程度の接着剤B高さを得る。そして、スペーサーを排除した後、接着剤Bの塗布されているフィルムを中間部材10上へ接着剤Bの表面張力を利用して置く。接着剤Bの塗布されているフィルムは柔軟であるためキャビティ形成基板完成体90の表面形状に追従して

接着剤Bの粘性により引き寄せられる。この時、接着剤B塗布部に気泡が混入しないように徐々にフィルムを中間部材10及び壁部材7b上へと置いていく。接着剤Bの当接した部分は、このフィルムを除去すると、均一高さhaに転写された接着剤Bを得る。フィルム転写は、被転写物の平面度に拘らず被転写物の形状に追従するため、接着剤Bの転写量はいずれの転写部分においても均一に転写される。本被転写物は、表面が矩形の連続であり、中間部材10が高所となっているため接着剤Bがその側面に少量塗布される。従って接合時の接着剤メニスカス形状が中間部材10の側面まで至り接合高強度を得ることができる。フィルム転写の特徴は、フィルムの剛性やフィルムの種類を被転写物の表面形状に合わせ選択し、接着剤の主成分、粘度を被転写物の表面積、表面状態に適したものを選択することで、様々な複雑なる表面形状、表面粗さの部品の接着剤塗布が塗布厚均一に容易に行える。以上のように容易なる方法で得られた中間部材10上の均一高さhaの接着剤Bに、図6のように圧電素子22aの固定台と固着されない半分の先端50と当接することで、圧電素子22aは壁部材7bと接合することなく、また金属薄板6へ接着剤が流出することなく安定して壁部材7aと接合することができる。

【0035】以上述べたごとく形成した圧電素子22と弾性部材8との結合構造は、圧電素子22の発生力を損失無くインク室5へ伝達できるものである。特徴としては、個々のインク吐出装置において、圧電素子22と弾性部材8間の結合構造は他からの拘束を全く受けないことにある。また中間部材10が樹脂であり軽いこと、その上接着剤塗布量が安定し中間部材10を設けていることにより位置合わせにマージンが広く取れ、容易に的確に当接するべく圧電素子22と弾性部材8とを接合できる。

【0036】

【発明の効果】以上説明したように、本発明のインクジェット式印字ヘッドは、ノズルと、該ノズルと連通するインク室と、該インク室の一部を形成する弾性部材と、該弾性部材と結合する圧電素子とを備え、弾性部材を圧電素子によって変位させてインク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、弾性部材と圧電素子が当接する部分に弾性部材と圧電素子の距離のバラツキを、当接する部分毎に補正する中間部材を設けたことにより、中間部材によって隣接部材との断差を管理することができるため、隣接壁部材との接合を防ぐことができ、平面方向で圧電素子の弾性部材に対する位置合わせのマージンを広くとることができ、圧電素子はその変位方向の横断方向に結合による負荷が加わらないため信頼性が得られる。その結果、圧電素子の変位を忠実且つ効率良くインク室に伝えることができるようになり、高速応答性を有するインク吐出特性の安定した高密度ヘッドを得ることがで

きるという効果を有する。

【0037】また、係るインクジェット式印字ヘッドにおいて、圧電素子の並び方向における中間部材の幅は、弾性部材及び圧電素子の幅より狭く、接着により固定されていることにより、並列に密接して配設されるインク吐出装置の圧電素子と壁部材間の結合構造で、接着剤流出による他との剛体化を防ぐことができ、インク吐出装置の高密度配列を可能にする。また、各部材間を強固に接合により結合させるため高速応答性を実現できるという効果を有する。

【図面の簡単な説明】

【図1】本発明の1実施例の構成を示す斜視図である。

【図2】同上実施例の部分断面図である。

【図3】同上実施例の90度回転した面の部分断面図である。

【図4】同上実施例を下方より見た部分斜視図である。

【図5】同上実施例を真上より見た平面図である。

【図6】本発明の効果を説明する部分断面図である。

【図7】本発明の他の実施例の部分断面図である。

【図8】本発明の他の実施例の部分断面図である。

【図9】本発明の1実施例の1製法を示す図である。

【図10】同上実施例の1製法を示す図である。

【図11】同上実施例の1製法を示す図である。

【図12】本発明の製造方法を説明する部分断面図である。

【図13】従来例の問題を説明する部分断面図である。

【符号の説明】

- | | |
|-------------------------|------------|
| 1、1a | ノズル基板 |
| 3、3d | キャビティ形成基板 |
| 5 | インク室 |
| 6 | 金属薄板 |
| 7、7a、7b | 壁部材 |
| 8、8a | 弾性部材 |
| 9a、9b、9c、9d、9e、9f | 接着剤の流動硬化状態 |
| 10、10d、10e、10f、14、15、16 | 中間部材 |
| 10a | 流動性物質 |
| 11 | ヘッドフレーム |
| 12 | 取り付け穴 |
| 21 | 固定台 |
| 22、22a | 圧電素子 |
| 23 | 共通板 |
| 24 | 配線パターン |
| 25 | リードフレーム |
| 27 | 脚部 |
| 28 | 軸受構成部材 |
| 31 | インク供給管 |
| 32 | インク接続口 |
| 33 | インク連絡口 |

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51	インク	62	ガラスマスク
60	ヘッドフレーム平面	90	キャビティ形成基板完成体
61	感光性樹脂フィルム（ドライフィル	91	ガラスマスク（基準平板）
ム）			